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CONTENTS:

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Editor's Note

Last November, I had the privilege of participating in a conference organized by Dr. Lucianne Lavin, director of the Institute for American Indian Studies in Washington, Connecticut, on the subject of New England's many stone constructions. Presenters included the State Archaeologists of Connecticut and Rhode Island, professional and amateur archaeologists, and Native Americans from three of the Connecticut tribal communities. With only one exception, all of these researchers were in agreement that at least some of the stone constructions are of Native American origin. Several of the Native groups – the Aquinnah Wampanoag, the Narragansett, the Mashantucket Pequot, and the Mohegan – announced at the conference that they have now formed a Ceremonial Stone Landscape consortium to preserve these sites and their environmental contexts.

It appears to me that we are at the beginning stages of the sound scientific investigation of these structures within their indigenous cultural context. In the course of my travels in pursuit of information about the distribution of these structures throughout the eastern seaboard of the U.S. and Canada, I have found that most of the state and provincial archaeological and historic preservation offices in the region accept these sites as part of the built landscape, and include them in their inventories, whether or not they are acknowledged as Native American sacred sites. This provides the sites with the same protections accorded to standing structures and buried archaeological sites under federal and state/provincial regulations. That they be so protected is perhaps more important than that we understand precisely what the uses of the structures was, or who built them. If they are destroyed as a result of the failure of the responsible historical preservation agencies to recognize and inventory them – as has, sadly, happened to quite a number of them already – we will never again have the opportunity to understand them.

The two main articles in this issue of the *Bulletin* address this issue squarely, from different perspectives. The first, by Mary Gage, uses a remarkable piece of documentary evidence, the diary of an 18th century Connecticut farmer, to document his uses of stone over the course of several decades. This gives us a clear indication of what sorts of stone constructions we can expect to be the result of colonial farm activities. By subtracting these from the remainder of stone constructions, Gage posits that the latter are likely to be of indigenous, pre-Contact origin, and she provides additional documentation for this conclusion. The second article, by Mary Ellen Lepionka and Mark Carlotto, represents a fine example of the "conjunctive approach" which Walter Taylor three generations ago (1983) insisted that archaeologists adopt. The authors, an archaeologist and an aerospace engineer, evaluate a likely astronomical observatory site in Gloucester, using both documentatary and quantitative methods to establish their case.

The final article in this issue is a retrospective, by long-time MAS member Bill Moody, of the reconstructive work of *Bulletin* editor William S. Fowler. Many long-term MAS members will doubtless appreciate Fowler's fine artwork, and his consummate skill in reconstructing broken artifacts.

Curtiss Hoffman
Ashland MA
February, 2015

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Testing the Stockpiling and Field Stone Clearing Pile Theories

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Abstract

This article tests the stockpiling and field clearing pile theories through a review of the period historical literature and through field testing.

Introduction

The archaeological community has largely argued that the stone piles found in New England are the result of historic field clearing or stockpiling activities by farmers (Provencher and Mahlstedt 2007:14, Ives 2013:52). In a 2013 article in *Northeast Anthropology*, Timothy Ives, of the Rhode Island Historical Preservation and Heritage Commission, concluded that, "In view of this context, it seems reasonable to presume that many, perhaps most, of the region's surviving stone piles, cairns, and cairnfields evidence early historic farming practices that have long been forgotten." (Ives 2013: 52) Ives does acknowledge that the Native Americans occasionally built isolated stone piles along trails as "memory piles."

How does one test the field clearing and stockpiling hypotheses? Today, the dismantling of a stone pile is avoided due to cultural sensitivity issues, but there are other ways of testing and dating a stone pile without disturbing its integrity. A trench can be excavated adjacent to it to determine the soil stratigraphy, to look for diagnostic artifacts, and for charcoal for C-14 dating. Soil samples can be taken from immediately below the pile and from the soil strata just above the base of the cairn for OSL dating and pollen analysis (if there are introduced plant species, it is post-Contact though not necessarily farm-related). The presence or absence of a plow zone can be determined. If a plow zone is present, is the bottom of the cairn above or below the plow zone? (If it is below the plow zone, it predates the farming activity.) The means exist to test the agricultural field clearing theory scientifically and archaeologically using standard techniques. Excavation, however, tests for only two aspects. Pattern analysis combined with historic documentation furthers the study. When used in conjunction with excavations, these two types of testing create a powerful analytical tool.

This paper focuses on pattern analysis, field testing and historical documentation to test the stockpiling and field clearing hypotheses. What follows are a series of questions the author posed to test various aspects of these hypotheses. One question led to another. These questions tested the hypotheses from two distinctly different perspectives: the historical record and field testing. In the final section of this paper, the basic underlying assumption that all stone piles are historic is put to the test as well.

Stockpiling Hypothesis

The stockpiling hypothesis argues that the stones were stored in piles either (a) for future building projects on the farm, or (b) for commercial sale (Ives 2013: 43).

Are there any historic references to farmers stockpiling stone for future building projects?
Stockpiling various materials in piles is a common practice that takes place in many industries, including farms. On farms there were dung piles and hay stacks. Although not generally mentioned in historical texts, some farmers on occasion stockpiled stones on their farms. Was it a common practice? Did farmers stockpile the stones by placing them in piles? Did farmers stockpile stone for sale? To answer these questions, the author searched Joshua Hempstead's extensive forty-seven year daily diary which covers the period 1711-1758 in New London, Connecticut (1901). He kept records of everyday activities. There were 457 entries which involved working with stone. The author also used historical agricultural accounts as a source.

Stockpiling -
From Joshua Hempstead's Diary:
"Dragged Some Large Stones into ye Garden behind the back Leantoo in ordr to Replace them whn opportunity p[r]sents". (May 31, 1754)

In this entry Hempstead states he dragged the stones to the location where he planned to use them at a future date. It shows that he stockpiled stone.

"in the foren [morning] was at home helping Dig & Draw Stones to the upper Cornr of the Lot." (March 31, 1740)

He makes no suggestion he piled the stones, only that he dragged the stones into a corner that was out of the way of his working area. He was stockpiling without making built piles.

There are a number of episodes in which Hempstead, with the help of others, dug up stones and dragged them out of the field. Most digging episodes were followed anywhere from a few days to a few months and up to a year or more later by the making of a stone wall. There is no question that Hempstead stockpiled stones. But was that a common practice?

From The Young Farmers' Manual by S. Edwards Todd (1859: 58-59):
"The first thing in building a stone fence, usually is, to haul the stone; and they are, usually, thrown in a long row, exactly where the fence is to stand. This is always wrong. If stones are gathered, from year to year, and hauled to a given place, for the purpose of making a stone fence, the place where it is to stand should be staked off, and no stone should be dropped within four feet of the point where the face of the wall is to be, on both sides of it. If the wall is to be made six or eight feet wide, on the bottom, no stone should be dropped nearer than six feet, especially if they are mostly large ones. It is a great fault with most farmers, who build stone fence, to get their stones too close to the wall. It is but the work of a few moments to tumble a large stone six or eight feet; and it is far better to have a stone one foot too far away, than to have it a foot too close to obstruct the progress of workmen."

The instructions show stone was stockpiled ahead of time, sometimes over a period of several years. It states the stone was "thrown in a long row". This shows the stone was not piled up. As with everything, there are exceptions. The author found one rare example in the field where stone was dumped in piles evenly spaced out across an intended length of the stone wall (Newton, NH). The piles were all the same size and contained all the same size stone (personal observation). The dumped piles were in a straight line between the ends of two parallel stone walls, thus confirming the piles were intended for a future stone wall. This is a distinct stone pile pattern.

No Stockpiling
Hempstead wrote, "finisht diging Stones & drawing & Laid up about Six Rod of wall on the Ditch by the appletrees." (May 14, 1757)

The stones were dug out, dragged to the ditch, and used to build the wall all during the same session. It was also common practice to dig out stones in tandem with construction projects like this one.

Stone Piles?
"I was at home all Day Diging up Large Stones & Laying ym on Small ones [stones] in order to Draw ym away in ye Winter when the ground is froze & Snow on it. Joshua & adm Drawing & Carting Stone &c." (April 29, 1742)

In this entry Hempstead had placed large stones on top of a bed of small stones. The other stones in the field were carted off that same day. He did not build stone heaps. The large stones placed on small stones were the only ones left on the field. Do these structures constitute stone piles? The answer lies in the size of the large stones.

Large Stones
"I [took] mr Coits horse & 2 oxen & Joyned with my six oxen to Draw a Large Stone ..." (October 19, 1744)

The entry shows the large stone was huge by our standards, as it took eight oxen and a horse to move the stone. Large stones such as this could not be piled. Hempstead's idea of a large stone compares to our modern day idea of a huge stone.

Such stones can not be piled without modern tractors. Hempstead was not building stone piles. He built low beds of small stones upon which he placed large stones likely rolled into place.

1859 – The Young Farmer's Manual
A chapter was titled "STONE FENCE". "The width of the wall on the ground must be determined, in part, by the size of the foundation stones. Should there be a good number of large bo[u]lders, from four to five feet in diameter, it will be best to have the wall about that width." (Todd 1959: 58)

This gives the average size of the large foundation stones. It shows large stones were in general used for the foundation of stone walls. It also shows that the term "foundation" referred to the base of stone walls. Hempstead repeatedly wrote in his journal about digging out large stones, sometimes referencing foundations. The foundations to which Hempstead was referring were the bases of stone walls surrounding lots of land, not cellars.

Time of year stones were dug out of ground and moved:
Hempstead's diary entries show he dug stone out of ground in all the months except for October and November: January 1755, February 1722, March 15, 1718 "digging stones. wee drew 30 load", April 1722, 1726, May 1724, 1757, June 1723, 1726, July 1746, 1748, August 1736, September 1755, 1758, and December 1742. He removed stones by four methods: sled, cart, truck (truck-cart), and dragging (tree-crotch, chains). He recorded removing stones in every month of the year. The most active months were March and April. For example the February 11, 1740 entry reads, "In foren I was at home drawing [dragging] great Stones out of the midle of the lott where they were Dug up in the Spring & Raised on Small ones [stones] & wee placed them by the Brook Side next [to] the Highway So-west of the House on the Ice & Snow." In this entry it can be seen that he set up the extra large stones too heavy to drag out of the thawed field on a bed of small stones so they would not freeze to the ground and left them for February, the only month he sledded stones.

Stone Heaps [Piles]:
Ironically, Hempstead did build stone piles in his work as a surveyor. He made four different types.

Pile on top of a boulder - "wee made ye heap of Stones on a Small Rock ..." (March 5, 1724)

Pile around base of tree - "made a heap of Stones Round ye 3. Elmn ..." (March 5, 1724)

Pile on ground with stake - "began at ditch in Champlins field wee made a heap of Stones & Stake" (May 6, 1726)

Pile on ground without stake - "made heap of Stones Every 20 Rod ..." (May 27, 1757)

Stone heaps were made on the ground (with a stake and without a stake), on top of small rocks (small boulder) and around trees. The heaps around trees became circles or rings of stones after the tree died and decayed. The distance of 20 rods was used twice. There were other distances as well: 80 rods and at every mile mark. The stone heaps (piles) are long distances apart and show up as individual features on the landscape. They are not part of groups of stone piles.

Discussion

Hempstead stockpiled stone for his own building projects. Logically, it makes common sense. At times he needed to clear his fields but was not ready to build a stone wall, so the stone was stockpiled. He walled in several plots of land over the years, often by segmented lengths, so that he frequently had ongoing wall building projects. To augment his wall segments, he extended them with wooden rail fences. He also added wooden rail fences to the top of some of his stone walls to make them higher.

Did Hempstead build stone piles?
On three occasions he wrote about putting large stones on top of small stones. His large stones could not be piled, judging by the number of oxen it took to drag the stones. These were not stone piles. When he surveyed properties for other people he sometimes made stone piles. They were single piles spaced out over long distances. Had Hempstead made individual heaps (piles) with his stockpiled stones he would have noted it in his diary as he did with the large boulders on small stones and the stone heaps he made for boundary markers. He did not.

Other farmers on occasion made stone piles by dumping the stone from a cart as seen in Newton, NH (unpublished site documented by author). These are not "built" or "constructed" but they are piles. The piles follow the normal pattern of placing stone along the line of an intended wall like the long irregular rows written about in historical accounts.

Did Hempstead stockpile building stone to sell?
Over the course of forty-seven years he made consistent daily entries, for a total of 17,098. Of those entries there are 457 related to stones (boundary and gravestones not included). There are also many business transactions. Among the business transactions there are transactions for gravestones. He purchased them pre-cut and sometimes pre-carved with designs, then he lettered the stones and sold the finished gravestones to his customers. He had one isolated transaction for trading stone. He traded blasted stone for a man's services of blasting the stone out (see next question below for details).

Hempstead recorded business transactions related to gravestones on a regular basis and included the one transaction related to trading building stone. It can therefore be extrapolated that he would have entered any transactions related to selling or trading building stones had they taken place. In this case, the lack of evidence confirms he did not sell building stones.

Did farmers trade building stones for services rendered?
Of the 17,000 plus diary entries, Hempstead only made a single reference to trading stone. The diary entry for May 24, 1757 reads "I finished the wheel & mended the Cart &c. adam pickt up Stones & put into the holes where the Rocks were Blown up & Carryed away to Jonathan Truemans Celler. I gave him all the Rocks & the Carting, for his blowing them to pieces &c."

In exchange for blasting the boulders, Jonathan Trueman received the blasted stone which he used in his cellar. The blasted pieces of stone often have flat faces and are block-like, making them suitable building stones. The small chunks of unusable blasted stone were used to fill up the hole left from blasting out the large stones.

Where did the stone dealers get their stones?
As of the 1770s stone dealers were advertising the sale of stone. Where did the stone dealers get their stone?

1803 Stone Quarry for Sale
In Little Cambridge, MA there was an advertisement for the sale of a quarry which had "excellent Building STONE". (March 5, 1803, *Columbian Centinel*)

The advertisement lists building stone but does not describe it.

1836 Quarry Prices for Cellar Stones
The American Builder's General Price Book and Estimator for 1836 published in Boston, MA (Gallier 1836: no page number) listed prime cost of materials and labor. Of interest to this section:

"PRICES OF GRANITE IN THE ROUGH AT THE QUARRIES.

Quincy Granite, per cubic foot, 45 to 55 cents
Ashler, per foot from 33 to 38 cents
Platforms, 2 feet 8 inches from 40 to 50 cents
Cellar Stone, from $1.25 to 2.50 per perch
Stone for Quay Walls, 50 cents per perch
Sandy Bay Granite, at the quarries – Stones, for hammering, 20 per cent less than the Quincy stone.
Eastern Granite at the quarries, 15 per cent lower than the Quincy Granite."

The list included cellar stones of varying quality as evidenced by the price range. Note the stone for the quay walls was a great deal cheaper. Based on wharf construction I have seen in Newburyport and Salem, the quality of stone used varies considerably. A quay is described as "a wharf or reinforced bank where ships are loaded and unloaded." (*The American Heritage Dictionary* 1985) There were differences in the quality of stone.

Commercial stone quarries were a major source of building stone. They likely were the stone dealers' main source, as they were able to supply the dealers on a regular basis. (Also see "Did Farmers

Sell Stone?") In Woonsocket, Rhode Island there was a local area where farmers quarried blocks from boulders. This local source from the 1800s was large enough to have been sold to contractors and possibly to stone dealers. (Morenon et al 1984)

What types of stones did the stone dealers sell and the contractors purchase?
Stone dealer ads and requests for contractor bids list cellar stone, well stone, fascia stone, etc. The lists assign a name but do not describe each type of stone. The following are a few examples of period advertisements from Massachusetts:

1790 Stone Dealer's Advertisement:
"The subscriber begs leave to inform the Publick and his Customers in particular, That he has for sale, all kinds of STONE, SLATE, CLAY and GRAVEL, at the lowest rate; cellar and well Stones, from 3s.6d. [$0.94] to 9 shillings [$2.25] per Perch.

Paving Stones, from 9d to 1s.6 per yard.
Slate from 6s. to 9s. per load
Sand from 2s.6 to 4s per ditto
Clay from 2s. to 4s per ditto
Gravel from 1s.6 to 4s. per ditto
Ballast from 1s. to 1s.6 per ton
Dreath Slate from 2d. to 3d. per foot
Hammered Stone from 1s. to 1s.6 per foot

All which will be delivered upon the spot, at the shortest notice, by calling at his House in Elliot-Street; and the smallest favour gratefully acknowledged, by SAMUEL ADAMS, Truckman.

Also, to be sold, by said Adams,
'Four good draught HORSES, and two pair of one-horse TRUCKS. April 28, 1790."

(May 5, 1790, *Massachusetts Centinel*)

In this advertisement cellar stones and well stones are listed. That implies there were differences between them. Those differences showed up during the field testing (discussed later in article). The stone dealer, in addition to stockpiling cellar and well stone, also had available paving stones, ballast [stones], hammered stones and two different grades of slate. This is a wide variety of stone types. The unit of measure by which the stone was sold also varied. It listed five different units: perch, per yard, per load, per ton and per [linear] foot.

Advertisements for Building Contractor Bids
"Wanted for building a new MEETING-HOUSE, in Brattle Street, Boston, the following Materials, viz.

Good Stones for the foundation and cellar, Stones for two or three courses above ground, to be hammered to a good face, each one foot in height, and not less to go into the wall.

Free Stone, or other kind of Stone of a light colour, that will answer for rustic quoins, &c."

(February 27, 1772, *Massachusetts Spy*)

Note: "Quoins are blocks of dressed stone used to form the corners between walls, often of greater size or more carefully formed than those that make up the wall." (Hislop 2000: 60) Quoins are often of a different color than the building stones.

From the town of Boston, MA:
"Agents for building an Alms House, hereby give notice, to all persons who may be willing to engage in the undertaking, that they will receive proposals for supplying and executing the following articles, viz.

Digging the cellar for the Alms-House, by the square.

400 perch of good cellar stones consisting of quarry and slate delivered on the spot, as will best accommodate the Masons.

600 feet running measure of hammered stone, 15 inches high, delivered in the same manner.

1900 feet running measure white stone, for facia, &c. delivered on the spot, and the stone-cutters to assist in laying them.

Laying the abovementioned articles by the perch."

(April 17, 1799, *Columbian Centinel*)

Note: Fascia stone are rectangular slabs of quarried stone used on the exterior of walls. The Alms-house was a brick building covered with a thin layer of white stone.

The two building contractor advertisements, although twenty years apart, show a consistency in the building stones required. Each one called for cellar stones and hammered stones. The two types

of stones are reflected in the type of stone sold by stone dealers like Samuel Adams.

The Almshouse called for a combination of quarry stone and slate for the cellar. An example of a foundation with these two types of stone was found at the Park House (1791) in Ayer, MA. It has schist and slate intermixed in the foundation.

The Meeting House called for hammered stone. Hammered stone was sold by the linear foot. It refers to stone shaped into rectangular bars with specific, uniform measurements. The Meeting House reference "to be hammered to a good face" is what gives this type of stone its name. The surface was hammered to a textured – flat surface.

The Almshouse cellar stone called for "quarry stone". The term implies the stone was split and came from a stone quarry. Today, quarried stone is associated with flat-faced, straight-sided blocks or bars of stone with quarry marks left from metal tools, but was that the criteria two hundred years ago? See the next question below.

The less expensive cellar stone went on the interior, and the more expensive hammered stone went on the exterior of the foundation that was above ground.

Does all quarried stone have quarry hole marks?
Most house foundations surveyed for this report did not have stone with quarry marks. Many had rough rectangular blocks of stone that are thought to have been shaped manually. Therefore this question is being explored.

Gresham described the quarry method for obtaining flagstone as follows: "Slabs are between one and six inches thick, with most between one and two inches. Stone is loosened and lifted with crowbars and wedges. Finished edges are made with a three-quarter inch chisel and two-pound rock hammers." (Gresham 1990: 26)

Slate and schist quarrying was done by John Park, who used flat steel wedges. (Park 1893: 147) An investigation of the John Park House in Ayer, MA indicates the schist was further cut to size with maul (i.e. sledgehammer) and sledge (i.e., a sledgehammer with an axe-like point on one end). Channeling and wedging methods were used independently and in conjunction with each other to split soft stone such as marble, sandstone and limestone. The wedging method involved cutting a V-shaped groove 2 to 3 inches deep with a pickaxe. The channeling method involved cutting a channel 1½ to 2 feet wide with a pickaxe. Each method is fully documented in the book *The Art of Splitting Stone* (Gage and Gage 2005: 21-23).

Hard stone could be split by using one of several fire methods. There was the "Fire and Iron Ball Method", "Fire and Hammer Method", "Fire and Wedge Method", and "Fire, Groove and Water Method". All of these methods were recorded and showed up in various historical sources. (Gage and Gage 2005: 17-18)

During the mid 1700s, the Germans introduced another method. The following information comes from Chief Justice Shaw's 1859 speech on New England quarrying. "... if the rock was in a quarry ..." the Germans blasted it with gunpowder to obtain rough pieces of stone. To square the pieces they proceeded by "... cutting a groove on a straight line with a hammer made with a cutting edge like that of a common axe, then striking it with a very heavy iron beetle [hammer] on each side of the groove alternately, until it would crack generally in the line of such groove." (Shaw 1859: 354-355)

An example of quarried stone without quarry marks was found in the foundation and exterior walls of the stone house (1759) at the Nathanial Hempstead House in New London, Connecticut (Nathaniel was Joshua's grandson.). This house was built from stone quarried from bedrock underneath it. It is an anomaly for its time period. The bedrock has the earliest recorded blast hole in New England. The stone was blasted and hammered into the shape of blocks. The foundation blocks were roughly shaped; some are not complete rectangles but have sloping ends (Figure 1). The exterior stone blocks were uniformly shaped (Figure 2). The quarry method could have been the German method or one of the fire methods.

These methods show that stone was quarried without leaving quarry marks. Quarry marks rarely show up on house cellar stones. That raises the

question of where the stone came from that was used in house cellars? Commercial quarries sold cellar stones. Joshua Hempstead's diary shows, farmers utilized stone on their farms to build cellars. That shows that field stone had a commercial value.

Figure 1. Cellar of Nathaniel Hempstead House (1759)

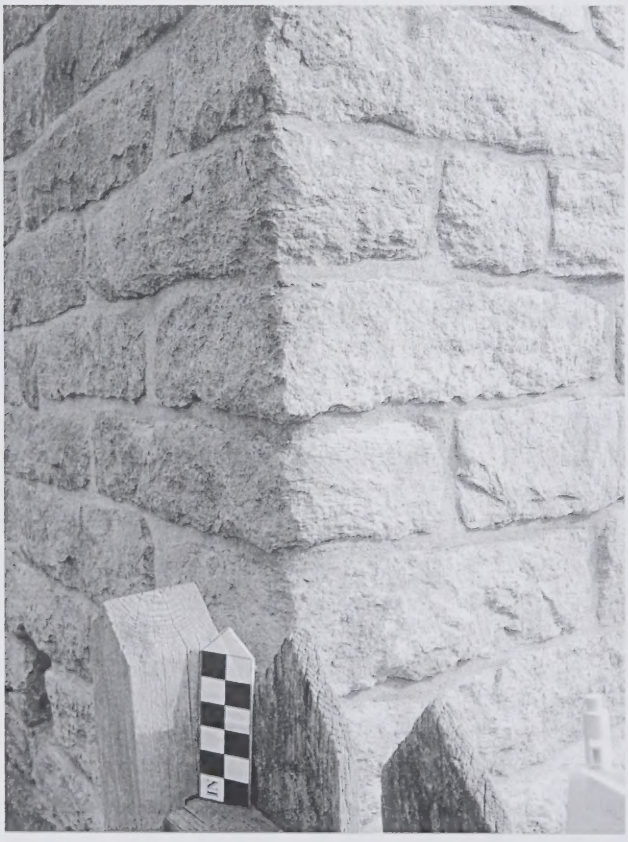


Figure 2. Exterior of the Nathaniel Hempstead House

Did Farmers Sell Stone?

The Essex Agricultural Society of Essex County, Massachusetts published two different reports that discuss selling field cleared stone. One report is an excellent source of what type of stone was sellable. After the flat wedge method and plug-and-feather method were developed (post 1800), farmers found they too could engage profitably in splitting and selling their quarried stone.

Field Stone (Essex County)

Jonathan Berry stated, "In 1848 the stones were taken out, and many of them sold for enough to pay the expense of removing them." Middleton, [MA], Nov. 8th, 1855 (Emery 1855: 115)

"In many places that are within three miles of some lively village or growing city, the stone removed from these rough pieces of pasture land can be sold and teamed for the building of house cellars, bank walls, and other similar uses, while, if the stones are large and heavy, they may be used in the building of bridges and the laying of heavy foundations for large blocks or factories, and the price is generally from seventy-five cents a perch for the poorest quality, to $1.50 for the large and heavy stone, of good shape, for building purposes, the average price in our county being probably from $1 to $1.25 a perch, for stone suitable for ordinary house cellars. A perch of stone is, exactly measured, 24¾ cubic feet, but is generally reckoned as 25 cubic feet, and will weigh, in squared granite, or large, solid stone, about two tons while the ordinary stone as dug from the ground and laid up, will weigh about 1½ tons to the perch; and of the latter, 1¼ to l½ perch will make a fair load for a common pair of farm horses, while, if the horses are very heavy and the road not too hard, a load of two perch will not be too much, and if the distance is but two miles from the field to the cellar, four trips will be a day's work; if the distance be three miles, three trips will be sufficient, and to do this, the loading and unloading must be done quickly, and though the team need not be hurried in doing it, yet there will be no time for the driver to stop and tell stories.

"There are two kinds of stone known as field stone, the round cobbles, such as are found in gravelly soil, and have no face, bed, or build to them, and are almost worthless, save for paving gutters and

drives, or grading, filling trenches, and the like, and the square-faced, solid, good shaped stone, such as are to be found in a heavy, clayey soil. It is of the latter that I have written, and, although in places where ledge stone is easily obtained, there will be encountered a strong prejudice against field stone, growing out of the idea that they are all like those first described, while stone from heavy soil will make as strong and substantial a wall as any ledge stone, and can often be split so as to make a good finish for exposed portions, or faced with granite for a finish, either way making the cost much less than by the use of ledge stone, which costs from $2.25 to $3 a perch; and beside this strong reason for the use of our field stone, is another, that every perch of stone taken from the field helps to improve the property, and the scenery of the vicinity of its former location, as well as to add to the ease and profit of cultivation, while the use of ledge stone only encourages the digging of an unsightly hole in the ground."
Chas. W. Mann, of Methuen [MA] (1887: 133-4)

In Mann's statement, he points out two types of field stones:

(1) Round cobbles that were almost worthless;
(2) The "square-faced, solid, good-shaped stone" that were good for building and selling.

What is interesting is that fields yielded two different types of field stones. This shows that not all field stone was of equal value and not all stone was building grade. He also points out the "strong prejudice against field stone". This suggests that not all farmers were able to sell their building grade field stones. In the 1800s farmers were competing against similar quarried stone. Commercial stone quarries were selling cellar stones. Mann also compared the square-faced field stone to quarried ledge building stone in usefulness and cost. Many of these farmers were astute businessmen.

His article talks about the removal of stones. He noted his farm "... yielded more than 300 perch of stone to the acre." This statement gives an idea of the large quantity of stone removed from a single acre. "... if the distance is but two miles from the field to cellar, four trips will be a day's work, if three miles ... yet there will be no time for the driver to stop and tell stories." This statement shows the stone was transported short distances of two or three miles to specific building sites and makes note of the socialization that went on.

This was a limited search on selling stone. It would be interesting to see if it occurred all over the Northeast or if it was limited as referenced by the prejudice against it.

The Essex County article stated that cobbles were almost worthless. In some areas, that was the only type of stone available. *The Young Farmers' Manual* gives instructions on how to build "COBBLESTONE FENCE":

"131. When stone fences are made of small stone alone, where there are no flat stones to bind the wall together, small strips of wood called binders, about an inch wide, and one-fourth of an inch thick, which are usually split out of cedar or some durable wood, are laid between all the courses of stone, ..." (pp. 59-60)

This shows small cobbles were used in some local areas by necessity, not by choice.

Quarried Boulders

Some farmers practiced a trade, especially during the winter months, to supplement their income. Did some farmers engage in the stone business? There is ample archaeological evidence in the form of small boulder quarries found on 19th century farms that they had small scale quarry businesses. A boulder quarry is a quarry in which glacial erratic boulders were systematically split apart into blocks and bars of stones suitable for a wide range of building purposes. The boulders were quarried using one of several different methods including blasting, plug-and-feather method, and flat wedge method. The stone was quarried and sold (Gage and Gage 2005: 9-13).

The Public Archaeology Program at Rhode Island College conducted a study of thirteen boulder quarries and one surface ledge quarry on a 100 acre parcel of land in Woonsocket, RI. (Morenon et al. 1984) No evidence of stockpiling of quarried stone was found at these quarry locations. This is consistent with the author's own findings explor-

ing ten boulder quarries and three surface ledge quarries. There is a practical reason for this. Stone quarries, whether seasonal operations or commercial ventures, cut the stone to fulfill specific orders. Each customer required a certain amount of stone with specific dimensions for their project.

Are there any bills of sale associated with stone dealers? One of the drawbacks to studying what the stone dealers sold is the lack of bills of sale. By chance, a payment record for stone was recorded and kept for a church's records. It has survived and is in a local library archive.

In the year 1800 the members of the Unitarian Church in Newburyport, MA built a new meeting house. The record of payments made for the New Meeting House survived and is in the Newburyport Library Archival Center. It has four line items associated with stone. (Gage and Gage 2013a)

July 11 – To Cash p'd liquor for people getting out stones $ 2.47
July 14 – Sam'l Culter's bill 11 Stones 57.25
October 6 – Caleb Abbots bill hauling Stone 15.67
October 8 – J. [Jacob] Galusia's bill Stones 289.16

The new lot of land contained a massive bedrock outcrop the length of the new meeting house and nearly the width. The meeting house (church) was built directly on top of the outcrop. The first account is related to reducing the outcrop and using it as a source to obtain cellar stone. The account suggests that a work party made up of members of the congregation provided free labor and were supplied with liquor, as was a common practice.

The second account was $57.25 paid for "11" stones. The price was too high for 11 perch. The most expensive cellar stone mentioned in the preceding 1790 advertisements was $2.25 per perch which would have come to $22.50. The 11 therefore represents a different unit of measure. Culter, the seller, was a merchant who sold a variety of items. The early date in the construction suggests these were cellar stones.

In the basement, a short section in the rear that houses the furnace has exposed walls and exposed bedrock outcrop. The outcrop is a light gray. Some of the cellar stones are dark gray. They are from a different source than the outcrop under the church, confirming that some of the cellar stone was purchased from a stone dealer.

The third account was for hauling stones and is dated for October. This indicates that Galusia, the stone dealer, purchased the stone from a quarry.

The fourth account for J. Galusia's [Jacob Galeucia's] stone bill was dated for October. An article in the *Newburyport Herald* on October 28, 1800 announced that the frame of the church had been completed. Putting up the frame in late October coincides with Galusia's stone bill from early October.

The exterior of the church contains hammered stone. Hammered stone is finished stone that is expensive, which is reflected in Galusia's bill of $289.16. Galusia's death record listed him as a stonecutter. (Massachusetts n.d). In Salem, MA around this same time, Lt. Governor Robbins met him when he went looking for the stone contractor of a building in that town. Galusia was the contractor and supplier of the stone; i.e., the stone dealer but not the quarryman. A man named Mr. Tarbox quarried the stone. (Shaw 1859: 357-359) In the 1799 advertisement for the Alms-House "1900 feet running measure white stone, for facia, &c. delivered on the spot, and the stone-cutters to assist in laying them." This shows that stone cutters worked at the building sites. It also indicates that Galusia's bill included both the stone and his labor. Galusia would have handled the final installation of the hammered stones, including any trimming and other adjustments which needed to be made to the length of the stones.

The Unitarian Church has the earliest example of the flat wedge method. At this point it appears to precede the commercial version of the plug-and-feather method (i.e. round holes spaced every 6-7 inches apart). Finished stone was hammered to create a textured surface but also to remove quarry marks. It took some sleuthing, but on one of the

finished stones a flat wedge mark was missed. In recent years, the church had some renovation and removed part of the old wall stones. They chose a few to be used on the grounds and kept one on display in the church yard. These stones have good examples of the flat wedge marks on the sides hidden from the public, confirming the method used to quarry the expensive stone bars. In comparison, one cellar stone had a blast hole mark; it was the only quarry mark found on the cellar stones.

The interior cellar stones were flat-faced, rectangular-shaped or square-shaped and of various sizes. These are the stones usually sold by the perch. The exterior foundation stones were long uniform bars of stone with a hammered surface. These are the hammered stones sold by the linear foot. The stones in the church's foundation match the listings by the stone dealers.

What types of stones were used in house and barn foundations, wells, and root cellars?
A field survey was done of house foundations, barn foundations, root cellars and wells to see what type of stone was used. A photographic example of each type of stone used in house, barn, root cellars and wells is presented here. (Figures 3 through 11)

Houses:

Figure 3. House Foundation, Bugsmouth Hill, South Hampton, NH – Cobble stones with semi-flat faces.

Figure 4. House foundation, Hampstead Forest, Hampstead, NH - Rectangular blocks with sharp edges.

Figure 5. House foundation, Crowd Site, Sturbridge, MA - Rectangular blocks with rounded edges.

Figure 6. Park House, Groton, MA - Large slabs of schist and slate, quarried by placing wedges in natural splits to pry loose. This type of stone was quarried locally.

Figure 7. House foundation, Lake of Isles Site, North Stonington, CT – Small slabs of local stone. Photo courtesy of Dan Nelson.

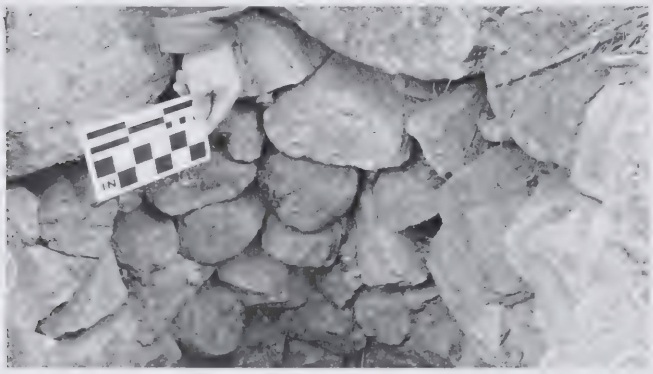


Figure 8. Well shaft, Pingree Farm Site, Georgetown, MA – 6 to 8 inch long blocks of stone with rounded edges. This type of stone was found in many of the wells with slight variations.

Barns

Figure 9. North Road Farm Barn, Fremont, NH – extra large blocks of stone with square, rectangular and triangular shapes, many of the large blocks of stone had small quarry hole marks.

Figure 10. Pingree Barn, Georgetown, MA – extra large blocks and large blocks of stone were the primary stones, some of the extra large blocks had blast hole marks. There were no small quarry hole marks on any of the stone.

Figure 11. Barn foundation at Farm Site, Thompson, CT – Slabs of stone (larger than used in the house foundations) with sharp edges. Lengths and thickness vary.

Root Cellar

Farm Site, Thompson, CT – This root cellar had the highest quality stone workmanship found anywhere. All the stones were short, thin slabs. The slabs were used in the walls and the arched roof (figs. 12 & 13).

Figure 12. Side wall of root cellar.

Figure 13. Roof of root cellar.

Were specific types of stones preferred?

A survey of 33 houses, 8 barns and 2 root cellars were included in the study. They represent structures from Massachusetts, New Hampshire, Connecticut and Rhode Island. To find out what was going on, the types of stones were charted. But before they could be charted the types of stones had to be assigned a name. To further refine the process, a set of letters were added to distinguish sharp edged ("SE") from rounded edged ("RE"). The sharp edged stone can be natural or can be quarried and shaped. The round edges show the stone was naturally formed.

Type of stone:

1. Blocks: thick, wide, flat faced stones in three shapes:
   - Square
   - Rectangular
   - Triangular (only used in barns)

   Sizes range from small 6" long to extra large >2' (foundations generally exhibit a range of sizes).
2. Slabs: thin, flat faced stones. Thickness varies from thin to thick. The slabs thin edge has a rectangular shape. It creates a layered architectural style. There were three primary lengths:
   - Short 6" to 11"
   - Medium Long 12" to 23"
   - Long >2'
3. Cobble stone: rounded stone
   - Cobble stone with semi-flat face and rounded edges
   - Cobble stone with rounded-out sides (ball like)
4. Irregular shaped stones: can be any size or thickness.

Town	Street	Site	F#	Types of Stone
Massachusetts				
Ayer	25 Groton St.	John Park House		Slab – medium long, long - SE
Byfield	South St.	Burns WMA	#1	Block – SE
Byfield	South St.	Burns WMA	#2	Block – SE
Georgetown	Pingree Rd.	G/R State Forest	#1	Block – SE
Georgetown	Pingree Rd.	G/R State Forest	#2	Block – SE
Georgetown	Pingree Rd.	G/R State Forest	#3	Block – SE
Georgetown	Pingree Rd.	G/R State Forest	#4	Block – SE
Rowley	Pingree Rd.	G/R State Forest	#5	Block – SE
Gloucester	Dogtown Rd.	Dogtown	#1	Block – RE
Gloucester	Dogtown Rd.	Dogtown	#2	Block – RE (Wall); Slab – RE (Steps)
Gloucester	Commons Rd.	Dogtown	#3	Block – SE; Slab - SE
Newbury	Downfall Rd.	Burns WMA	#1	Block – SE
Newbury	Downfall Rd.	Burns WMA	#2	Block – SE
Newbury	Downfall Rd.	Burns WMA	#3	Block – SE
Newbury	Downfall Rd.	Burns WMA	#4	Block – SE
W. Newbury	Paddy Rock Rd.	Crane WMA	#1	Irregular – small stones
Sturbridge	New Boston Rd.	Opacum Woods	#1	Block, Slab, Irregular – SE
Sturbridge	New Boston Rd.	Opacum Woods	#2	Block – SE; Slab - SE
Sturbridge	Leadmine Rd.	Crowd		Slabs – Short – RE
Sturbridge	Cooper Rd.	Weld		Slab – long, medium long & short - SE; Blocks & Slabs (one wall)

F# = Foundation #

Burns WMA = Martin Burns Wildlife Management Area

G/R State Forest = Georgetown / Rowley State Forest

Figure 14. House Foundations (Massachusetts)

Town	Street / Site	F#	Types of Stone
New Hampshire			
Chester	Chester Turnpike	#1	Block – RE
Chester	Chester Turnpike	#2	Block – SE
Franconia	Mt. Lafayette Hotel on summit		Block – SE
Hampstead	West Road (Hampstead Forest)		Block – SE; Slab – short, medium long – SE
New Hampton	Sky Pond Forest		(wall A) Block – SE; (wall B) Slab – medium long – SE;(wall C) Irregular, Block, Slab; (wall D) Block / Slab – SE
Raymond	Pawtuckaway State Park		Slab – short, medium long, SE
So. Hampton	Bugsmouth Hill		Cobble – semi-flat faced (3 walls); Block – SE (Chimney base)
Stratham	Lane House		Block – SE

Figure 15. House Foundations (New Hampshire)

Town	Street / Site	F#	Types of Stone
Connecticut			
Groton	Gungywamp – Adams House		Slab – short, medium long – SE
Groton	Groton-Copp Park		Slab – short – SE; Block – SE (a few mixed in)
New London	Nathanial Hempstead House		Block – SE (quarry)
No. Stonington	Lake of Isles Site		Slab – short, medium long – SE
Thompson	East Thompson Rd.		Slab – short – SE
Rhode Island			
W. Greenwich	Tarbox Pond		Large odd shaped blocks – low

Figure 16. House Foundations (Connecticut, Rhode Island)

Town	Street / Site		F#	Types of Stone
Massachusetts				
Georgetown	Pingree Rd. (G/R State Forest)			Block – SE (shape: square, rectangular, triangular
Newbury	Downfall Rd. (Burns WMA)			Block – SE
	Quabbin Reservoir			Slab – medium long, long – SE; Block – SE (a few mixed in)
New Hampshire				
Fremont	North Road Farm			Block – SE (shapes: square, rectan-gular, triangular)
Hampstead	Governor's Estate, Big Island Pond			Block – SE
S. Hampton	Bugsmouth Hill		#1	Cobble
S. Hampton	Bugsmouth Hill		#2	Cobble
Connecticut				
Thompson	East Thompson Road			Slab – short, medium long, & long – SE;Block – SE (a few square and rectangular shaped mixed in)

Figure 17. Barn Foundations

Town	Street / Site		Types of Stone
Massachusetts			
East Brookfield	North Street		Block & Slab mixed (Slab - short, medium long, long)
Connecticut			
Thompson	East Thompson Road		Slab – short – SE

Figure 18. Root Cellars

	Massachusetts (21)	New Hampshire (8)	Connecticut (4)	Rhode Island (1)
Blocks	17	6	2	1
Slabs	4	3	4	0
Cobbles	0	1	0	0

Figure 19. House Foundations

Findings

Several foundations had a mix of types of stone, so the count does not match the number of foundations listed.

	Massachusetts (3)	New Hampshire (4)	Connecticut (1)	Rhode Island (0)
Blocks	3	2	1	0
Slabs	1	0	1	0
Cobbles	0	2	0	0

Figure 20. Barn Foundations

	Massachusetts (1)	New Hampshire (0)	Connecticut (1)	Rhode Island (0)
Slabs	0	0	1	0
Blocks & Slabs	1	0	0	0

Figure 21. Root Cellars

The data shows that blocks of stone with flat faces were the preferred type of building stone in Massachusetts and New Hampshire. Where the slab type stone was abundant, as in Connecticut, it was the preferred building stone type.

Did the builders have a choice of stone?

Two sites were chosen and explored to look for the various types of stones found at each site. The Georgetown/Rowley State Forest site survey was a walkover by the author. The Lake of Isles site survey was conducted through a set of photographs sent to the author. Stone walls and foundations were the primary sources. At each site there were long walls enclosing pastures and bordering roads. The stones in the walls were compared to the stones in the foundations. Did the stones in the walls show up in the foundations? Were the stones in the foundations different from the stones in the walls?

1) Georgetown/Rowley State Forest in Massachusetts

Cobble and irregular angular stones were found in stone walls, with one exception. At the well-to-do large Pingree farm, about a 100 foot length of wall bordering the road in front of the house had the same type of block style stone as found in the foundations. This short section of wall was used to showcase the house and farm entrance. The rest of the stone walls on the property were made up primarily of irregular sharp edged stones and a few cobble type stones mixed in. The five house foundations in the area representing individual homesteads and/or farms all had rectangular flat faced stone blocks.

2) Lake of Isles Site, North Stonington, Connecticut

Irregular sharp edged stones are seen in stone walls versus the slab type stone found in the foun-

dation. The fact that a few slabs showed up in some of the stone piles indicates that the slab is a local type of stone.

The presence of various types of stone found on each site suggests that the farmers made choices. The example at the Pingree farm shows that farmers made choices as to what type of stone was used in the common stone walls versus the foundations. This example holds up throughout the Georgetown/Rowley State Forest, which was a local community. It also showed up at the Lake of Isles where the angular, irregular stones were relegated to the stone walls and the favored stone slabs were selected for the foundation.

Do the stones in the stone piles match the stones in the foundations?

In the two cases listed below, stone piles were in close proximity to the foundations. The stone in the stone piles was compared to the stone in the foundation to see if there were any similarities or differences. One site had a partially built foundation. That raised the question whether stone was stock piled in the piles for building purposes? The other site had numerous large stone piles of the type thought to be stockpiling piles. The type of stone in these large stone piles was compared to the stone used in the house foundation.

1) South Street, Byfield, Massachusetts

The author conducted a phase one survey of the site, documenting the above-ground structures. No excavations were undertaken. The site had two foundations, one in the process of being built (Figure 22). This foundation had one end walled up and two long berms extending out from the end wall. The end wall showed the type of stone being used. It was blocks with flat faces and sharp edges. The second foundation in the adjacent lot had been fully stone-lined. Three of that foundation's walls had been covered with a thin layer of cement. The exposed (4th) end wall showed the type of stone. It was blocks with flat faces and sharp edges.

There were stone piles in both lots. The stones in the stone piles were irregular angular types (Figure 23). The stones in the piles did not match the stones in the foundations.

Figure 22. Foundation #1 at South Street Site.

Figure 23. Stone cairn A22 at South Street Site. Note: The small stones which are not found in either foundation at the site.

2) Lake of Isles Site, North Stonington, Connecticut

A photo galley of this site was sent to the author by Dan Nelson. He photographed a wide range of examples existing on the site. There was a house foundation with some terracing around it. There were stone walls along property and/or field borders. Stone piles in a variety of designs were within the stone walled-in areas. In addition, Nelson showed a few overall shots of the landscape. It was a cursory but thorough set of photographs, depicting the site in general.

The house foundation was constructed using slabs of various lengths (Figure 25). The stone piles contained primarily small blocks of stones, with a few piles that had one to three slabs mixed in (Figure

23). The piles were not stacked with slabs of stone as would be expected had they been intended for building usage. Slabs made up a tiny minority (in one case studied, about 7%) of the type of stones found in the stone piles.

Figure 24. Stone pile at the Lake of Isles Site
Photo courtesy of Dan Nelson.

Do the stones in the piles match the stones in the boundary walls?
The Buell Hill site in Killingworth, CT was chosen. The site has twelve large vertical-walled stone piles and hundreds of smaller ones. The stones in the piles are mostly rounded or blocks with flat faces and smooth edges. They range in size from small to medium to large with a few extra large. One pile has a couple of stone slabs. Some of the piles have large exterior wall stones and small interior fill stones.

In one photograph there is a stone wall with blocks of stone like those found in the stone piles. In another photograph, stone slabs are on top of the wall. Dr. Curtiss Hoffman in "Analysis of Stone Features, The Ridges at Deer Lake Housing Development Property, Killingworth, Connecticut" stated, "the stone walls are for the most part carefully constructed of lamellar slabs of stone, while the stone in the piles are mostly spherical or blocky pieces." (Hoffman 2004: 20)

Hoffman points out most of the stone walls were constructed using slabs of stone. The stone piles contain blocky and spherical shaped stones. The stones in the piles do not match the stones in the walls, except for one wall. This same scenario occurred at the Byfield, MA site. Most of the stones in the piles did not match the stones used to construct the boundary walls.

Are the stone piles contemporary with the walls?
An often overlooked aspect is the age of the structures. For four hundred years, Euro-Americans have been building stone walls. Over that time period, farms have been bought and sold regularly. Stone walls have been built, torn down, disposed of and new walls built. At sites with both types of structures, without knowing the age of the stone piles and stone walls it cannot be determined if they are contemporary with each other.

What were the farmer's intentions regarding his stone piles?
Historical agricultural accounts give a number of options as to what to do with the stone removed from fields. It should be noted that field clearing of stones only occurred on crop and hay fields and not in pastures or woodlots. (J. Gage 2014) Joshua Hempstead's diary also noted how the stone was utilized:

1) Temporary piles for later removal from field
2) Stone walls for pastures and boundaries
3) Wide stone walls for disposal of unwanted stones removed from the field
4) Stone for paving short sections of road
5) Stone for building dams and bridges on farms
6) Underground (below ground) ditches filled with unwanted stone
7) Stone piled up in a field and left indefinitely

To know what a farmer had intended to use his stone piles for there needs to be a diary. Without a diary there is no way to answer the question. (There is one exception see "Field Clearing Hypothesis case #3" – see below).

Stockpiling Hypothesis Discussion

Joshua Hempstead's diary confirms that farmers stockpiled field-cleared and blasted building stones for projects around the farm. However, his diary lacks any mention of making piles

of stockpiled stone to sell, or to selling building stone. Two articles in the *Essex* (Massachusetts) *Agricultural Society Annual Reports* show that some farmers sold field-cleared building stones. (Emery 1855, Mann 1887) It is unclear if this was a local practice or Northeastern U.S.-wide practice. Post-1800 small boulder quarries attest to the fact that farmers engaged in selling quarried stone.

Large commercial quarries had been in business long before the new splitting methods were developed. They utilized older methods to split the stones. The commercial quarries were likely the main source for stone dealers throughout the historic period. The 1836 price book comparison listed both cellar stones and hammered stones. It shows that commercial quarries were selling the types of stone that the stone dealers were advertising. That gave the stone dealers reliable sources from which to obtain their stones.

The field testing explored the types of stone found in the foundations to find out what was being used. The foundation stones in turn were compared with stone in the stone piles on some of these sites. In the two examples used, the stones in the piles did not match the stones in the foundations.

Stone in the piles was also compared to stone in a few stone walls. This was not done on a large scale. There are some sites where the stone in the piles is different from the stone in the walls. At other sites the stone in the piles are similar to the stone in the walls. Walls and farmer-built stone piles have been built for the past four hundred years. To find out if there is a correlation between the piles and walls, there is a need for dating both types of structures and diary entries to confirm it. Both have to be part of the conclusion to make it a scientific study.

A search of the historical literature found no mention of building/constructing piles of stone for future use or sale. (J. Gage 2014) Stone was stockpiled by dumping in loose, haphazard piles in field corners and along intended lengths of stone walls. It was not stored in vertical wall stone cairns.

Stone piles do exist, as evidenced by the South Street site and Lake of Isles site. Are there field clearing piles of non-buildable stones? Although Joshua Hempstead does not appear to have built field clearing piles, was he an exception? Did other farmers construct field clearing piles? These questions are answered directly and indirectly below.

Field Clearing Hypothesis

The field clearing hypothesis argues that the stones removed from farm fields were placed in piles. (Provencher and Mahlstedt 2007; Ives 2013, 52)

James Gage, who has published an article in the *Bulletin of the Archaeological Society of Connecticut* (2014) on field clearing practices, conveyed to me he had found sixty-one references to farmers removing stones from plowed fields and hay meadows. Of those references, twenty-two relate to stone heaps (piles). Six examples have been included in this article; see below.

Field Clearing Piles

#1 – Peterborough, New Hampshire

The account comes from Jonathan Smith's children, who told the story. As a boy of five or seven (one of two brothers) he worked at "picking up stones". He was paid "a small reward in money for a certain number of heaps ..." by his father. That was in the year 1808. (Smith 1900: 123)

#2 – St Albans, Vermont

"Occasionally we see stones piled in heaps in a field. It may sometimes be necessary to do this when seeding down to grass, but they should be removed as soon as possible certainly not be allowed to remain until another year. These heaps take up considerable room and are always in the way, interfering with every kind of farming operation. Get them out of the way by putting in walls, underdrains or large heaps in some corner of the field." (*St. Albans Daily Messenger*, Aug. 11, 1879)

The account mentioned seeing heaps of stones in the fields. It recommended that the stone be used for building purposes. If no building project was going on then the stones should be put in corners. Hempstead in one of his diary entries (Mar. 3, 1740) mentions moving stones into a corner of the field.

#3 – New York
"Where a farm contains field stone of a proper size for laying into a wall, this material can be used to a good advantage. In estimating the cost, it will be assumed that every good farmer should clear his farm from all such stones as will be a hindrance in plowing and putting in crops. In this case he naturally places them in convenient piles. Instead of piling he should haul them to a line of fence, which expense will cost extra from piling say twenty-five cents per cubic yard. Making the fence two feet wide on the bottom, one foot on the top and four feet high, will require three and two-thirds cubic yards to a rod length." (Shull 1870: 747)

This account indicates "field stone of proper size for laying into a wall" was put into "convenient piles". That shows some stone was stockpiled in piles (mounds). To confirm if the stone piles in a particular field were made to stockpile for future wall building, the stone in all the piles must match what was used in the stone walls. Plus, the piles must all be the same design (a mound) and size, as that was how farmers built their field clearing piles (see Figure 17). To date, the author has not found any examples in her field survey.

The account also shows the cost of hauling the stones to the wall line. It notes the size of the wall and how much stone was required to build it. These farmers were businessmen.

#4 – Massachusetts
"Before planting I removed the rock from a field of about five acres that was seeded to grass the year before, and also cleared about six acres of rock heaps where they averaged about a heap of four to six bushels of small stones per square rod." (Massachusetts Board of Agriculture 1866: 3)

This account indicates that there were approximately 960 piles all the same size and type within the six acre plot of land. (There was approximately one stone pile per square rod. A rod is 16½ feet. A square rod is 272.25 square feet. An acre has 43,560 square feet. There are 160 sq. rods in an acre. The figures indicate there were 160 stone heaps per acre, for a total of 960 stone heaps for the entire six acres.)

It should be noted that this statement does not allow one to identify the maker of the stone heaps.

Figure 25. 1937 photograph of field with stone piles and stumps (Sando Evanoff's Farm, Iron County, Michigan, photo by Russell Lee, Farm Services Administration) Courtesy of the Library of Congress.

#5 -- Methuen, Massachusetts
"... yielded more than 300 perch of stone to the acre."

This quote is from an "Essay on Reclaiming Rocky Pastures" by Chas. W. Mann (1887). It should be noted that pastures were being converted into crop fields.

This article shows from a different perspective that the total number of stones in statement (#4) was not overestimated.

#6 -- Temple, New Hampshire
Isaac Kimball wrote "In one instance a ditch was dug ten feet wide, and some ten rods in length, for a cart-way and filled with stone. The stones were brought from the fields adjacent, some were blasted, other dug from the fields. Old walls removed, and unsightly heaps, long a nuisance, all thus congregated, probably to be seen no more." (Kimball 1857: 105)

The "unsightly heaps" were present on the farm when he purchased it. He blamed the previous tenants who had leased the farm for seven years. What we do not know is if it was the tenants or others who built the heaps.

Discussion

The references show that stone was cleared from fields and put into piles by farmers. All the accounts mention heaps of stones suggesting mound type piles. One account noted the large number of piles he found and cleared. The last account notes the piles were already on the property. That farmer blamed the previous tenants who rented the land and left it in deplorable condition. There is a general assumption that all stone piles are the result of historical agricultural activities. Is this assumption scientifically sound?

The stone pile looks like it is a field clearing pile. The question, is it?
Two examples are presented. In the first example, an excavation of what appears to be a field clearing pile produced some surprising C-14 dates. The second example deals with looking for hidden features like hollow interiors which, when found, reveal that the stone pile is not a farmer's stone pile.

Cairn Excavation – Freetown, Massachusetts
In 1982 a stone pile [mound] was excavated in Freetown, MA. The excavators/authors James Mavor and Byron Dix were shown a group of stone mounds by some Native Americans who gave their blessing to excavate one. A survey of the property showed that there were one hundred ten stone mounds in the group.

The photograph on page 69 of their book *Manitou* of the mound prior to excavation shows a loose pile of stones on level ground. It was surrounded by young sapling trees, a sign the land had been open field and was in the process of reforestation. The stone pile looked like a field clearing pile as there was a mix of different size stones. On the surface all the criteria was in place to confirm the pile was constructed from field stone clearing activity.

Data from the excavation of the stone mound:
From *Manitou* (Mavor and Dix 1989: 66-75)

Size:
Above ground – twelve feet diameter by thirty inches high
Below ground – twelve feet diameter by twenty-eight inches deep

Contents:
Charcoal – two deposits each twelve inches diameter by four inches high (at different heights and places inside the mound)
Red Ochre – 120 pieces weighing ten pounds were deep inside the mound

C-14 Dates:
875 ± 160 B.P. (GX-9783)
790 ± 150 B.P. (GX-9784)

The evidence shows that the stone mound, stone pile, or cairn -- whatever name people choose to call it by -- was not a field clearing pile. The presence of red ochre is consistent with Native American practices. The earlier C-14 date places the beginnings of the construction in the middle part of the Late Woodland period. The two charcoal deposits were intentional features and reliable dating sources. The calibration of the first date shows that the stone mound was started between 962 and 697 years ago (CalPal n.d.). The excavated stone mound was a ceremonial cairn constructed by Native Americans. As further evidence of this, a "manitou" stone was embedded within the dated cairn, as reported by Mavor and Dix.

Miniature Stone Chambers
1- Hopkinton, Rhode Island
2- Pachaug State Forest, Voluntown, Connecticut
From outward appearances, this type of structure can be mistaken as a dome-shaped field clearing pile, especially if the lintel stone and opening is covered with debris or not seen initially. Two stone piles with hollow interiors were found, one at each site (Figure 26). Each pile had a lintel stone with a low opening (6" high) at the base resembling a niche. The front opening gave the researcher a means to feel inside the stone pile. By reaching inside (Figure 27) with his hand and arm, the researcher could feel around without moving a single stone to find out if the feature was a niche or an opening into a hollow interior.

[Caution: First shine a flashlight inside to check for snakes or other critters before reaching inside with your hand. This is how the first one was discovered by Steve Dimarzo, Pete Dimarzo and Todd Carden. Documentation of the structure: On exterior, take photographs of all four sides and

top down. Record the hollow interior with your camera from the inside. Turn on the flash. Set the camera dial for portrait, place a glove or piece of paper under the camera, then slide the camera inside through the opening and push the button to take a photograph. If the portrait setting does not work, try a close-up setting.]

Figure 26. Hollow stone cairn / Miniature Chamber, Pachaug Forest, Voluntown, CT
Photo courtesy of Steve Dimarzo Jr.

Figure 27. Researcher reaching inside of the cairn via the niche opening.
Photo courtesy of Steve Dimarzo, Jr.

The low opening leading into a hollow interior shows that this type of structure is a miniature stone chamber. It was found at a Native American ceremonial cairn site.

These examples show that the outward appearance of stone piles can be deceiving. They also reveal that not all stone piles are the product of farming practices.

Field Clearing Hypothesis Discussion

The historical accounts confirm that farmers built field clearing piles. They show that the piles were all about the same size, quite numerous and all of the same design. An early 20th century photo (Figure 25) of numerous piles in the field is consistent with historical accounts like the one describing one stone pile per square rod. The high yield of 300 perch of stones per acre described in a different article also attests to how numerous the piles could be.

The excavation of the Freetown cairn and the two examples of stone piles with hollow interiors called miniature chambers confirm that Native Americans built stone piles.

The Freetown cairn is a great example of how a stone pile can be misconstrued as being built by one culture (farmer) and in reality had been built by another culture (Native Americans). Its outward appearance mimics a field clearing pile. This presents a conundrum, as both cultures built groups of stone piles. Can field documentation solve this problem?

Is there a way to identify the two cultures' stone piles? According to the accounts, farmers built field clearing stone piles, sometimes called heaps and other times called piles. The term heap suggests mounds of stone that are all the same. Documentation conducted by the author and her research partner and son, James Gage, show that there are other groups of stone piles with diverse designs. We argue the differences in the two types of groups: (a) all the same design and (b) diverse designs, are one way to distinguish who built which groups of stone piles.

Standing Stone Niche Site Sandown, NH

This stone pile site is situated in a forest on dry rocky land. There is a two-sided vertical walled V-shaped enclosure, a niche with a standing stone on top aligned to the equinox sunset, two surface ledge stone quarries, one short segment of stone wall, and 90 stone piles (Gage 2009). The stone piles (here called cairns) had multiple designs. There were three basic designs:

(1) on ground – pile built directly on the ground (sizes varied from small to large)
(2) on top of boulder – pile built on top of a boulder
(3) split stone – stones placed inside a split.

Figure 28. Cairn on Ground (A005) Standing Stone Niche Site.

Figure 29. Cairn on Boulder (A021) (white arrows point to two other cairns on boulders; tape on tree in background marks property boundary), Standing Stone Niche Site.

Cairn A005 is an on ground design (Figure 28). Cairn A021 is an on top of boulder design (Figure 29). In this photograph there are three on boulder cairns that are in close proximity to each other. The close proximity is far too close for field clearing, when compared to the one stone pile per square rod (272.25 square feet) figure cited previously. Furthermore, the three cairns shown in Figure 29 are far too small to be field clearing piles. (Each contains less than one bushel of stones.) This is based on the historical account that states that the piles contained four to six bushels of stone and on the early 20th century photo (Figure 25).

The site contains a diverse group of cairns with several different designs, which is not consistent with field clearing. It contains two different types of structures in addition to the stone piles (cairns). They are a niche and a two sided V-shaped enclosure. The niche and enclosure, which are not historic utilitarian structures, combined with the group of cairns that contained several different designs, identifies the stone structures as Native American.

The diversity of different types of structures has been documented at other sites in eastern United States and Canada. Curtiss Hoffman, in his presentation titled "Prayers in Stone: Stone Constructions of the Atlantic Seaboard of the U.S. and Canada", reported that approximately 25% of sites with stone constructions have multiple constructions. About 30% of sites with stone piles have other constructions. Stone constructions, "include: cairns (well-built ground piles), stone piles (all other types), U-structures, chambers, standing stones, split-filled boulders, balanced rocks, marked stones, petroglyphs, stone circles, effigies, mounds, platforms, enclosures, niches, and 'unique features'". (Hoffman 2014)

The site also has two small surface ledge quarries with drilled round hole marks showing historic usage of the property. There are small grout piles of waste stone adjacent to the quarries which are easily identified by the quarry marks. The grout are irregular and misshapen pieces of unusable granite.

The age of the cairns is unknown. It would be helpful, but it is not critical. Historical and anthropo-

logical records documented continuous use of Native American stone structures and other related ceremonial structures well into the historic period (M. Gage 2013a). There is evidence of pre-contact Native Americans building large groups of cairns, as evidenced by the Freetown cairn group.

The use of cairns in the Native American culture dates back at least 5,000 years ago to a small pile of stones found adjacent to a grave at the Beaver Meadow Brook Site at Sewall's Falls in Concord, NH. The description reads: "consisted of stacked cobbles and stones" (Howe 1988: 59, 61). The large group of cairns in Freetown shows the practice was well established by the Late Woodland/Ceramic period. Eva Butler (1946) found 18th century documents by missionaries describing Native Americans continuing to add stones to existing ceremonial stone cairns. Cairn sites integrated into old farm sites (personal documentation) show that the practice continued into the 1800s.

Native American sites often have other ceremonial stone structures in addition to cairns. Cairns cannot be dated without scientific methods. However, sometimes structures like niches, enclosures, standing stones and occasionally Manitou stones can be dated to the historic period. (Manitou stones have a specific shape: short narrow neck, sloping shoulders – often one shoulder is longer than the other, and rectangular body. In comparison, standing stones range from narrow post like stones to wide, flat, thin slabs – short and tall versions occur.) At the Opacum Woods site, Sturbridge, MA, a Native American niche feature was integrated into the boundary wall (M. Gage 2011a). At the Ashburnham site an enclosure with a niche/shaft feature had bars of stone with quarry marks, placing construction in the historic period (M. Gage 2013b). At another site in Massachusetts, an undisclosed Native American structure was built on top of the rubble pile of a collapsed chimney.

To see Native American examples and to get an idea of how the Native Americans utilized the structures, see *A Handbook of Stone Structures* (Gage and Gage 2011), and the web pages: "Historic Links to Stone Structures" and "Standing Stone Niche Site, Sandown NH" (M. Gage 2009, 2011b) which has good examples of these structures but is not a farm site. The author used non-farm sites to establish the basic Native American structures and features, thereby avoiding misinterpreting farm features of the same names but with different designs and uses.

Discussion

Native American ceremonial cairns are often on sites with other types of historic stone structures or quarries, as is the case at Sandown. This shows the vital need to find a way to identify each culture's stone structures. In historical accounts there is documentation of historic farmers field clearing and stockpiling. The historical accounts describe types, sizes, layouts, and quantity of stone piles. This information can be used to identify historic farmers' utilitarian stone piles, and also can be used for comparison purposes.

Understanding the historic farm features is a starting point. Documenting stone structure sites is the main resource. Through documentation, the historic farm utilitarian stone structures can be sorted out by using historical accounts. Through documentation, the Native American stone structures can be identified through their diversity, e.g., cairns (stone piles) with different designs within the same group.

Conclusion

This paper set out to test the theory that all of New England's stone piles were either constructed to stockpile stones for future building projects and future sales, or as field clearing piles. The historical record confirmed that farmers built large groups of stone piles during field clearing episodes. The archaeological record confirmed that Native Americans built stone piles in large groups. The historical record confirmed that Native Americans continued to build stone piles into the historic period.

Through field surveys it was discovered that the type of stone found in many stone piles did not match the type of stone found in the foundations. This proved that foundation stones were not stockpiled in piles. The historical record was

searched, and in it was found a description of the type of stone sold for foundations as "square-faced, solid". The description matches what was discovered during the field survey: that flat-faced, square or rectangular blocks of stone constituted the majority of stones in many house foundations. The historical record matched the field record.

Building projects included stone walls, which required large quantities of stone. Stone walls were the primary use for field stones. A limited survey via photographs was done. It showed that stones in piles sometimes matched and sometimes did not match stones in walls. The sites involved all had a diversity of cairn designs. This is an important factor. A New York historical account mentioned that farmers built piles of usable building stones. Farmer type piles within a field are all the same size and design: mounds. To confirm this type of site, the stones in the piles would need to match the stones in the local walls. The soil within the piles and walls would also have to be dated using OSL to see if they are contemporary with each other. Sometimes Native American stone piles mimic the field clearing stone piles. In cases like that, OSL soil dating is imperative.

To study stone piles it is necessary to broaden the scope of the research. It has to include stone removal and a study of every type of stone structure built using the dry masonry method. The list includes: stone walls, enclosures, niches, stone chambers, stone root cellars, stone foundations (house, barn, privy), stone farm bridges, underground (below ground) drains, culverts, built-up sections of roads and cart ways, boundary markers, and wells. It is a complex, involved undertaking.

Stone piles were built by two cultures: historic farmers and Native Americans. Their active use spans at least a 950 year period from circa 1000 A.D. up to 1940 A.D. The American farmer historic period ranges from 1620 to 1937. The Native American period ranges from at least 1000 up to at least the 1930s. The latter is subject to change when more dates become available.

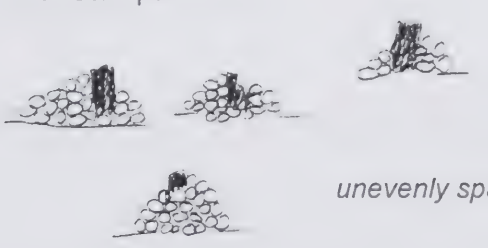
The historical accounts of trailside stone heaps (Butler 1946) and Mashpee brush and stone heaps (Simmons 1986: 252-254) show that the Native Americans used stone as an offering. That confirms ritual and ceremonial usage. It also confirms a sacred aspect to the stone. Farmers viewed stone from a utilitarian point of view as an obstruction, a building material, and a sellable commodity. In addition, farmers had the habit of using a single design whereas Native American sites are well known for their diversity. Utilizing the two cultures' different perspectives of stone, it is sometimes possible to sort out who built which stone piles.

Ceremonies always involve a variety of activities which show up as multiple designs within groups of stone piles. These were permanent piles. Field clearing involved building all the same size piles — either small or large and all of the same design. These were built on the ground. Most were temporary piles. An understanding of each culture's building practices regarding stone piles permits study. To study stone piles it is necessary to do field documentation of sites to evaluate what types of stone piles are present. This will determine which culture built the stone piles at a particular site. This is a case by case study.

Field Clearing Stone Piles Criteria

1) On Ground Mound
   One account stated – all the same size (four to six bushels)
2) Around stumps – on ground, unevenly spaced out due to placement of stumps, broken down due to decay of stumps
3) Without stumps – on ground, evenly spaced out, mounds intact
4) Large stone on top of a bed of small stones. Temporary storage of large stones, removed in winter. (Hempstead)

With Stumps



unevenly spaced out

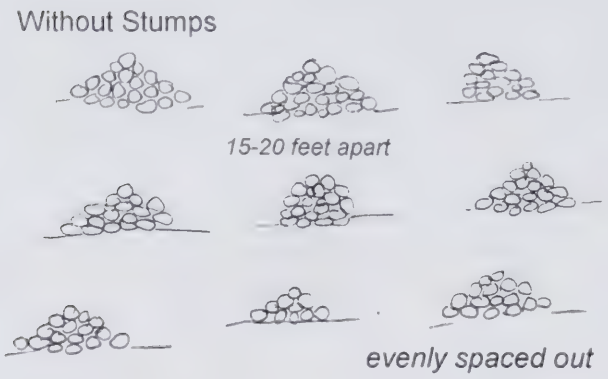


Figure 30. Field Clearing Stone Piles Criteria.

Native American Cairns Criteria

1) On Ground – Sizes range from 3′ diameter up to 40′ + long
   Shapes: mound, conical, vertical walled
2) On Top of Boulder – many variations of this basic design
3) Split Boulder – with stones inside split or on top of split boulder
4) Other stone structures – many sites have additional structures like niches, enclosures, and standing stones.

Spacing between cairns is irregular and uneven. Designs are mixed, two or more designs per cairn group.

Note: Stone walls are frequently found at both types of sites. It is often difficult to identify which culture built the walls.

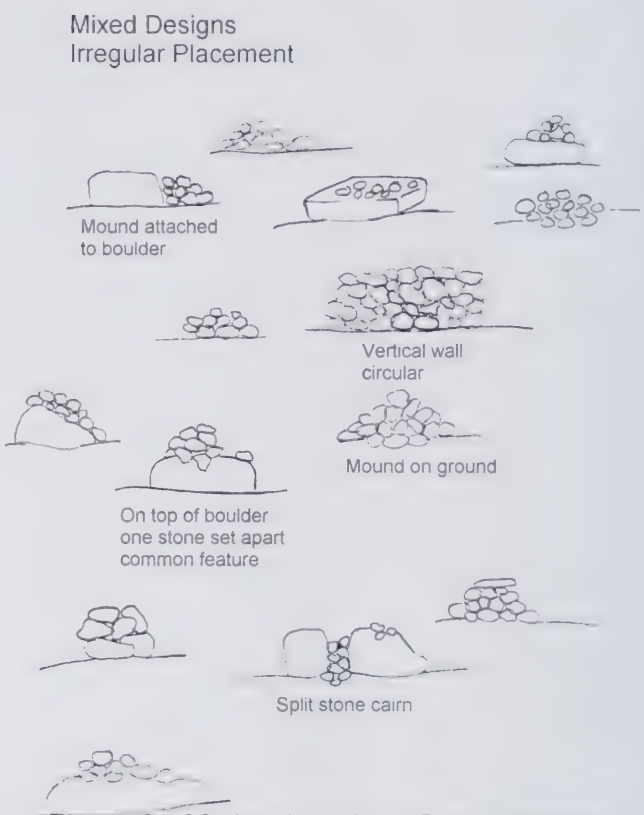


Figure 31. Native American Cairns Criteria.

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Evidence of a Native American Solar Observatory on Sunset Hill in Gloucester, Massachusetts

Mary Ellen Lepionka
Mark Carlotto

Abstract:

Evidence supporting the existence of a solar observatory on Sunset Hill, also known as Poles Hill or Pole Hill, in Gloucester Massachusetts, is presented. Sitting atop a kame overlooking two tidal rivers, the Annisquam and Mill River, the site was important to Native Americans. Archaeological data indicate they occupied nearby Riverview seasonally during the Archaic and Woodland periods up to the time of English contact (Lepionka 2013; Phillips 1940-41; Pool 1823). This study is the result of collaboration between an anthropologist (Lepionka) and an aerospace engineer (Carlotto). Combining ground observations with aerial data we have identified three key seasonal alignments. Two alignments (summer solstice sunrise and sunset) are marked by fixed boulders relative to a central reference boulder or gnomon near the middle of the site. The winter solstice sunrise is defined by two large, flat, stacked stones to the southeast. There is also evidence of an equinox sunrise alignment. We describe tools and methods used to identify these markers and determine line of sight. We also provide ethnological background information and discuss several areas for future work.

Anthropologist's Report:

As part of my survey of archaeological and documentary evidence for Native Americans on Cape Ann, I developed maps showing the locations of sites, artifactual finds, and significant landscape features. Studying landscape features in Google Earth, I wondered if the escarpment of outcrops above Riverview, a known Native site of some antiquity, could have been a solar observatory. The public access site, off Sunset Hill Road at the end of Dexter Road and off Riverview Road in Gloucester, is also known as Pole or Poles Hill. An area called Sunset Rock is identified as the Robinson Reservation, protected in 1980 under the aegis of the Essex County Greenbelt Association. In 1998, the City of Gloucester purchased Poles Hill and in 1999 voted to conserve the land.

The area known as Riverview in Gloucester on Cape Ann is a north-south aligned kame on an outflow plain (Figure 1). It is flanked by two tidal rivers, Mill River and the larger Annisquam River. The kame is about two and a half kilometers long and one kilometer wide at its widest point at mid-tide, and contains fresh water springs and patches

Figure 1. Satellite image of location of Riverview on Cape Ann (Imagery courtesy MassGIS and Google Earth.)

Figure 2. Satellite image of Poles Hill/Sunset Hill in Riverview (Imagery courtesy MassGIS and Google Earth.)

of wetland. Riverview has water access to two other rivers, Little River and Jones River to the west; and to the islands, saltmarshes, clamflats, harbors, and beaches of Essex Bay, Ipswich Bay, and Massachusetts Bay. The location and estuarine environments are optimal for human occupation. I had determined through unpublished documentary and archaeological evidence that there was a large Native village in Riverview with satellite camps in surrounding areas at the time of contact and during millennia of previous seasonal occupation. Artifact collections studied so far appear to date at least as early as the Middle Archaic (Lepionka 2013).

In satellite imagery, there are many rock features on Sunset Hill, potential false horizons, and possible sight lines for alignments (Figure 2). It's possible that important Algonquian settlement areas had a site for making solar, lunar, planetary, and astral observations, and that such sites aligned with other observatories in adjacent areas (Leonard 1987, 2010; Ballard and Mavor 2006; Bell 2013; Fohl 2014; Hoffman and Fournier 2013; Ring, Goss, and Leonard 2013). Native astronomical observatories have been identified or proposed at sites from Maine to New York to the Potomac River Valley in Virginia; for example, at Salem, NH, Sharon, MA, Carlisle, MA, Turners Falls, MA, Groton, CT, and other places (e.g., Ballard 1999; Nassaney 1999; Dix and Mavor 1981; Gage 2013; Fohl 2010; Barron and Mason 1994; Hoffman and Fournier 2013; Martin et al. 2012; Martin 2014). Algonquian astronomy also can be compared to Southwestern, Aztecan, and Mayan calendrical systems (Eddy 1974; Edmunson 1988; Aveni 1980; McCluskey 1982; Fohl and Leonard 2006; Drucker 2014).

Ethnographic data records the importance of solstice and equinox dates in Native American ceremonial time, as well as the position of the stars, Milky Way, and other events, such as the position of Draco in relation to the horizon, the rising and setting of the Pleiades, and eclipses (Mitchell 1984; Hoffman 1987; Gookin 1674; Morton 1637; Rale 1901; Williams 1643; Hranicky 2001). The Milky Way, when perpendicular to and touching the horizon, for example, was seen as a way for spirits to enter the skyworld. Algonquian cosmology is based on a view of the universe as circular and cyclical and defined by the intersection of astronomical phenomena with earthly horizons (Campion 2012). The rising and setting of the sun at particular times of the year, the lunar cycle, the ascension of the planets and brightest stars, the wheeling of the constellations, position of the Milky Way, meteor showers – these guide or dictate daily life (Chamberlain 1982; Wood 1978; Lankford 2007). Daily life is a slow dance in nonlinear time within a circular space defined in part by the cardinal directions. Dimensions of experience may be organized in relation to north, south, east, west — the

sky itself, the medicine wheel, village planning, offerings and prayers, colors and attributes, the human life cycle, and burial alignments (Bragdon 1996; Kidwell 2003).

This cosmology is the basis of Algonquian astrology, in which astronomical phenomena directly affect individuals, their community, and the natural world. Like a Caddoan-speaking Skidi Pawnee on a vision quest, for example, an individual may choose a particular star as a personal guardian (Speck 1920, 1935; Chamberlain 1982; Torrence 1994). The community may traditionally conduct ceremonies such as namings and healings and initiations, and seasonal celebrations such as the Green Corn Festival, at the right times as determined by astronomical observations. Last harvest follows the appearance of the Pleiades in the Fall, for example, signaling the coming of the first hard frost. First sowing follows the constellation's disappearance (Ceci 1978).

The Algonquian natural world is populated with entities and events that are gods or spirits or are governed by gods or spirits or contain spiritual power, or manitou, including, for example, springs, trees, rocks, animals, people, and weather, all of which are believed to be influenced by astronomical phenomena or are understood in terms of them (Simmons 1986; Mavor and Dix 1989). Algonquian mythology links this spiritual natural world with the skyworld, earthworld, and underworld in their stories of gods and creation, moral dilemmas, and culture history (Leland 1884; Winiarski 2005). For example, the story of the hunters in pursuit of the Great Bear – which rises, is wounded, retreats, and reappears – mirrors the celestial movements of the constellation known as the Big Dipper (Olcott 1911).

On June 21, 2013, having decided to see if my theory could have any merit, I stumbled over a big outcrop onto Poles Hill/Sunset Hill and found myself on an expanse of grooved bedrock. Serendipitously, before me was a large slope-shouldered pointed boulder with a smaller companion beyond it. I took pictures of them. These boulders sit at the head of a serpentine ribbon of bedrock. In Algonquian mythology, the serpent motif – the one with a long winding tail – represented rivers and a river spirit regarded as potentially dangerous to people (Boutet 2011). The serpent motif is also associated with the circumpolar constellation, Draco, the dragon, and its star Thuban, which was in the position of the North Star millennia ago (Lankford 2007; Kreisberg 2010).

I had earlier photographed all the faces of the hill and used my compass to establish their cardinal directions, subtracting 15 degrees to account for the declination between true north and magnetic north. Then, wondering if the pointed rock could possibly be some kind of gnomon or sighting guide, I sat for a long while, as the day waned, and watched. I was astonished to see the sun set exactly on the tip of that boulder, casting a long shadow across the bedrock where I stood. It was June 21, the sunset of the summer solstice. I resolved to look for the stones of a possible solar calendar.

Exploring and researching Sunset Hill, I found it bisected by one north-south aligned trail with bedrock and boulders rising sharply on either side. There are vernal ponds and two springs, one of which was diverted in colonial times to create a small permanent pond that was later drained. Colonists used the hill to graze livestock and pick huckleberries (Babson 1860). Historical photographs show it as barren terrain, treeless and strewn with boulders (Figure 3). The trail represents the central axis of the site. I returned a few times as the season changed to provide better visibility, and I found a landscape strewn with unusual boulders and possible features and sightlines. The hill is less than 40 meters in elevation, but in winter and early spring it affords a 360-degree view of the entire area. The panoramics of the place would have constituted an optimal false horizon for all sorts of astronomical observations.

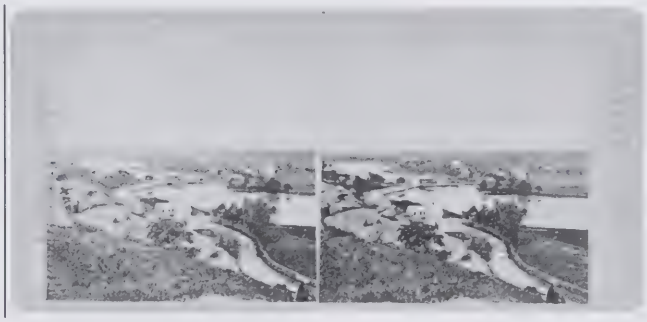

Figure 3. Late 19th century stereogram view of Riverdale from Poles Hill.

Figure 4 shows a schematic of the solar calendar and the site geometry ultimately discovered on Sunset Hill. Based on the work of early ethnologists, such as Frank Speck, modern anthropologists, such as Kathleen Bragdon, independent scholars such as Ted Ballard, astronomers such as Ken Leonard, and others, we aim to understand the site as an Algonquian ceremonial calendar as well.

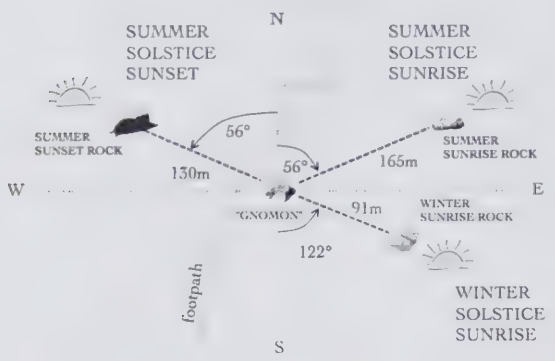

Figure 4. Schematic of the site's solar calendar.

Interpretations of stone structures in the Northeast have been problematic for five main reasons. First, many sites have been tampered with, with rocks repositioned, repurposed, or removed (e.g., Barron & Mason 1994; Goudsward and Stone 2003; Gage and Gage 2008). In addition, traditional beliefs, even including those of archaeologists, have held that Native Americans of the Northeast built no monuments and therefore must not have been capable of the scale of stoneworks evidenced, for example, in Mesoamerican civilizations (Feder 2011). In sources too numerous to mention, wedged split boulders and effigy stones made by Algonquians have been attributed to glaciers, Vikings, Celts, or colonists, for example (not to mention aliens). Third, the Massachusetts Department of Recreation and Conservation attributes all stone structures in New England to European settlers and claims to be "debunking the myths" about Native Americans building "walls, piles, or chambers", including solar alignments (Provencher and Mahlstedt 2007). The state historical commission does not include above-ground "prehistoric" sites in their inventories and keeps secret the archaeological reports of excavations of below-ground sites, ostensibly to prevent looting. Tribal councils often deny the existence of such sites too, not out of disbelief but for fear of looting or desecration. On the other side are optimistic claims for the Native agency of most rock piles, or for their spiritual symbolisms as religious architecture (Gage 2013). Overly positive claims can strain credibility no less than negative ones. The fifth reason is the sad compromising of valid scientific inquiry through fanciful interpretations and the writings and practices of New Age enthusiasts and spiritualists, who appropriate Native American concepts, customs, regalia, and places for fringe religions based on mysticism. Because of its subject matter, valid academic disciplines like archaeoastronomy attract those looking for something other than science. Given these problems, I resolved to assess the archaeological integrity and scientific validity of Sunset Hill. I also realized the site would need to be evaluated by others with backgrounds and skills in mapping, astronomy, and geology.

Aerospace Engineer's Report

On my first visit to Sunset Hill, also known as Pole (or Poles) Hill, I expected to find an arrangement of stones that would clearly show the direction of the summer solstice sunset. What I found instead was a chaotic landscape – a rocky plateau strewn with boulders and rock ledges and fractured bedrock not unlike other parts of Cape Ann.

Although I had found several rocks that looked suspicious on my first visit, only after returning a few weeks later with several photographs was I able to identify "sunset rock" (Figure 5) and the place one would have to stand to see the sun setting behind it, a sighting stone 130 meters away, referred to as the "gnomon" (Figure 6). Saving the geo-coordinates

Figure 5. Sunset rock located to the northwest of the gnomon.

Figure 6. The "gnomon", a rock that serves as a reference point for viewing solstice sunset and sunrise events.

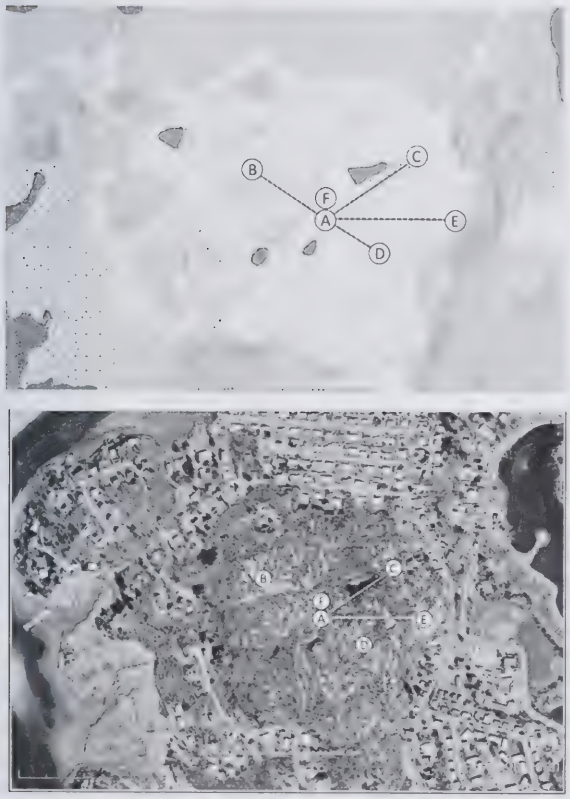

Figure 7a and b. Topographic map (a) and aerial image (b) over Sunset Hill. Site map showing key features: A) gnomon, B) summer solstice sunset rock, C) summer solstice sunrise rock, D) winter solstice sunrise rock, E) equinox sunrise location, and F) north reference point. (Imagery courtesy MassGIS and Google Earth.)

of these rocks on my GPS, I plotted their location in Google Earth (Figure 7a & 7b).

I then used Google Earth to search for rock-like features in the direction of the summer solstice sunrise along a line at an azimuth angle of 56°. I found what appeared to be a boulder in that direction about 165 meters away (Figure 8). The rock was roughly the same size as sunset rock in the Google Earth image. I hypothesized that, like sunset rock, this "sunrise rock" also would be visible from the gnomon.

Figure 8. The larger of two rocks northeast of the gnomon that may mark the direction of the summer solstice sunrise.

A few days later I ventured out on an unseasonably cold March afternoon and found two candidate rocks a few feet from each other. The larger one (Figure 8) would most certainly be visible from the gnomon, provided there was a clear line of sight. The other smaller boulder (Figure 9) had a more angular or pointed shape, its position suggesting that it may also have played a role in alignment.

Figure 9. Another smaller rock within a few feet of the larger rock in Figure 8 that may also serve as a sunrise marker .

Although the view of sunset rock from the gnomon is unobstructed, the presence of bushes and trees to the east makes it impossible to see sunrise rock or any other feature in its vicinity. A rough line-of-sight analysis using Google Earth suggested a view did exist; however, it was clear that additional survey work would be required to determine if the summer solstice sunrise would in fact be visible over sunrise rock when viewed from the gnomon.

Having found possible summer solstice markers, I wondered about the equinoxes. On the first day of spring (and fall) the sun rises due east and sets due west. Following a line west from the gnomon on Google Earth, the terrain gradually slopes down to the Annisquam River. There did not appear to be any equinoctial markers visible in Google Earth imagery in that direction. However, drawing a line eastwards appeared to pass near an outcrop on the highest point on Poles Hill.

While the gnomon and sunset rock can be easily reached from the main path bisecting Poles Hill, it was much more difficult to get to sunrise rock. I followed a series of meandering paths through huckleberry and cat briar that eventually lead to the east side of Poles Hill and sunrise rock. I retraced my steps a few days later to locate the high point I had found on Google Earth east of the gnomon.

The terrain on the north and south sides of the hill falls off gradually compared to the east side, which drops precipitously down to Washington Street. Using GPS, I found the high point was on a knuckle of rock near the edge (Figure 10). Stepping up on the rock, I found a geological survey mark next to a number of holes and pieces of metal anchored in the rock. I was at a location a few degrees north of east from the gnomon.

Figure 10. Rock with survey marker at the highest point on Sunset Hill.

According to my co-author, historical sources refer to a flagpole at or near this site during the late 1800s, referred to as Dr. Babson's flagpole, which is seen in old photos (Peterson File 1894; Gloucester Daily Times, August 21, 1964). As a place name, "Pole Hill" appears in other New England towns as well as in England, where in the 17th Century a hill with a pole (or by that name with or without an actual pole) marked a boundary between two polling districts or neighborhoods. She says it is conceivable that Pole or Poles Hill originally differentiated the Native American community at Riverview from the abutting colonial community at "Gloaster Plantation" (Babson 1860). Another

local explanation is that poles were erected on the hill as a navigational aid to locate the mouth of the Annisquam River or Gloucester Harbor. Otherwise, one can only speculate that the Algonquians or colonists at Riverview established a precedent for driving "poles" into Sunset Hill for use as observational aids. An early map of the area identifies the site as Huckleberry Hill (Mason 1831).

Finally, I investigated winter solstice sunrise and sunset directions (122° and 238°). The shape of the plateau is such that the terrain to the west and southwest are not high enough for boulders in those directions to be seen from the gnomon. Looking the other way, there appeared to be a rock visible in Google Earth imagery at 122°. Guided by my GPS, a short hike to the spot confirmed there was a rock present about 91 meters away from the gnomon. This was not a single shaped boulder like the other markers I had found, but two large flat stones stacked one on top of the other (Figure 11a & 11b). Like the summer sunrise rock, the

Figure 11a and b. Two views of possible winter sunrise stacked rocks looking southeast (a) and southwest (b)

winter sunrise rock was obscured by trees and brush when viewed from the gnomon. However, a rough line-of-sight analysis using Google Earth's ruler tool suggested that, based on the underlying terrain data, it would be otherwise visible.

Figure 12 lists the geo-coordinates of the gnomon, summer solstice sunrise and sunset, and winter solstice sunrise rocks plotted in Figure 5. The coordinates are the center locations of the features in the August 24, 2013 Google Earth image. The

Rock	Latitude	Longitude	Elevation (m)
Gnomon	42.6293	-70.6826	31
Summer Solstice Sunrise	42.6301	-70.6809	30
Summer Solstice Sunset	42.6299	-70.6839	34
Winter Solstice Sunrise	42.6289	-70.6816	33

Figure 12. Feature geo-coordinates at Sunset Hill (August 25, 2013).

latitude and longitude are in decimal degrees and the elevation is in meters. The challenge of determining if the various solstice rocks are observable from the central gnomon is illustrated in Figure 13 a and b. Fortunately, in early spring 2014, when the emergence of foliage was still several weeks away, sight lines to the summer and winter sunrise rocks were confirmed through direct observation of a bright reflecting object through tree branches at each location by an observer at the gnomon.

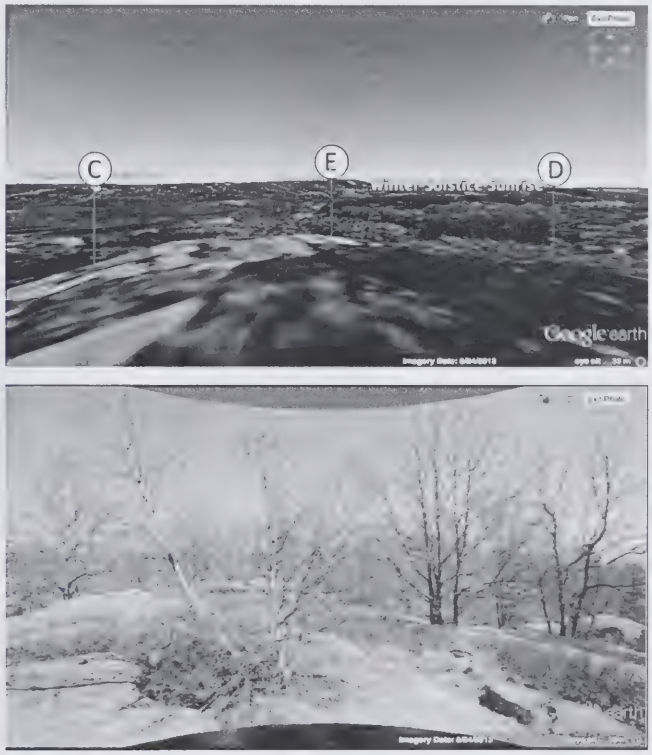

Figure 13a and b. Google Earth ground view looking east from gnomon (a) and actual view taken with panoramic camera (b). The pan camera image is rendered as a KML photo-overlay (KML 2014).

Analysis of Alignments

Figure 14 provides a key to the symbols for the variables used in the following and subsequent mathematical analyses. Figure 15 gives the measured

headings (azimuth angles), α, and elevation angles, θ, of the three solstice rocks relative to the gnomon,

Symbol	Definition
α	Heading (azimuth) angle defined CW from true north
θ	Elevation angle relative to local tangent plane
$(\varphi_0, \lambda_0, z_0)$	Latitude, longitude, and elevation (in meters) of gnomon
(φ, λ, z)	Latitude, longitude, and elevation of a marker rock
a	WGS-84 equatorial radius
b	WGS-84 polar radius
δ	Solar declination angle – measured north or south of the celestial equator, along the hour circle passing through the sun
ε	Axial tilt (obliquity) of the Earth
r_0	Radius of gnomon (shape approximated as a sphere)
d_1	Distance between gnomon and summer solstice sunrise marker
p_1	Probability of summer solstice sunrise alignment
d_2	Distance between gnomon and summer solstice sunset marker
p_2	Probability of summer solstice sunset alignment
d_3	Distance between gnomon and winter solstice sunrise marker
p_3	Probability of winter solstice sunrise alignment

Figure 14. Key to symbols used in mathematical analyses.

Event	Azimuth	Elevation
Summer Solstice Sunrise	55.81	-0.35
Summer Solstice Sunset	304.06	1.33
Winter Solstice Sunrise	121.77	1.25

Figure 15. Measured azimuth and elevation angles at each solstice rock relative to gnomon.

(Equation 1)

$$\alpha = \tan^{-1}\left(\frac{Y}{X}\right)$$

$$\theta = \tan^{-1}\left(\frac{z - z_0}{\sqrt{X^2 + Y^2}}\right)$$

where

$$X = \left(\frac{\varphi - \varphi_0}{360}\right) 2\pi\, a \cos\left(\frac{\varphi + \varphi_0}{2}\right)$$

$$Y = \left(\frac{\lambda - \lambda_0}{360}\right) 2\pi\, b$$

(Equation 2)

constants a = 6378130 and b = 6356752.3 are the WGS-84 equatorial and polar radii (WGS 2014).

A simple analytical model (Solar Azimuth 2014) can be used to compute the solar azimuth angle α as a function of the solar elevation angle, θ, the latitude of the site, ϕ, and the solar declination, δ_1:

(Equation 3)

$$\cos a = \frac{\sin\delta - \sin\theta \sin\phi}{\cos\theta \cos\phi}$$

where the declination varies with season, reaching

(Equation 4)

$$-\varepsilon \le \delta \le +\varepsilon$$

its largest and smallest values in the summer and winter in the northern hemisphere, respectively, where ε is the Earth's axial tilt. Depending on the desired accuracy, the values in Equation 3 must be corrected near the horizon for atmospheric refraction, which causes the sun to appear higher in the sky than it really is.

Since Earth's axial tilt varies over time, it is often used in archaeoastronomy as a means for dating a site by determining when various alignments are satisfied. We measured the accuracy of the solar model in Equation 3 against published sunrise/sunset angle tables and found errors on the order of ±0.4° (Figure 16). Needing a better model for archaeoastronomy, we decided to use NOAA's on-line solar calculator (NOAA 2014) that corrects for atmospheric refraction. The calculator has a stated accuracy of 1′ (0.017°) between 2000 BCE and 3000 CE.

Event	Simple model	NOAA solar calculator	Error
Summer Solstice Sunrise	56.74	56.35	-0.39
Summer Solstice Sunset	303.26	303.62	0.36
Winter Solstice Sunrise	122.17	121.87	-0.3

Figure 16. Differences between simple model and NOAA solar calculator for 2014 azimuth angles.

Figure 17 shows the predicted summer and winter solstice sunrise and summer solstice sunset azimuth angles at "apparent" sunrise/sunset, when the limb of the sun appears at the horizon for three time periods: the present time, 2000 B.P., and 4000 B.P. Figure 18 plots differences between the measured and predicted angles.

Event	Present	2000 BP	4000 BP
Summer Solstice Sunrise	56.35	56.02	55.60
Summer Solstice Sunset	303.62	303.98	304.35
Winter Solstice Sunrise	121.87	122.24	122.52

Figure 17. Solstice azimuths at apparent sunrise/sunset.

The measured angles shown are averages computed from three Google Earth background images. Based on previous work (Carlotto 2012), we used Google Earth to measure the location of the gnomon and other rocks (Figure 12) instead of a GPS. Although the absolute accuracy of Google Earth is relatively poor (about 10 meters in this area), it has good relative (point-to-point) accuracy. We extracted the geo-coordinates of the gnomon, summer sunrise/sunset, and winter sunrise rocks in Google Earth August 24, 2013, June 18, 2010, and April 17, 2008 images, and used the coordinates to estimate three sets of azimuth angles (Figure 19), which we then averaged. The averaged values are the measured azimuth angles used in all of the alignment calculations.

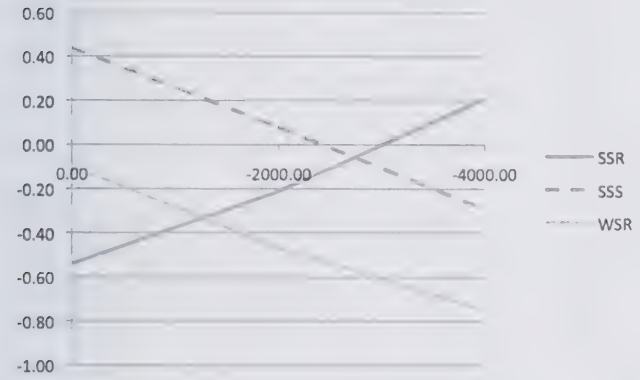

Figure 18. Azimuth angle differences (flat horizon) for the summer solstice sunrise (SSR), summer solstice sunset (SSS), and winter solstice sunrise (WSR) for three dates.

Date	Summer Sunrise	Summer Sunset	Winter Sunrise
4/17/08	55.7619	304.1484	121.6843
6/18/10	55.7386	304.1456	121.8408
8/24/13	55.9246	303.8835	121.7921
Average (Stdev.)	55.81 (0.10)	304.06 (0.15)	121.77 (0.08)

Figure 19. Measured azimuth angles from three Google Earth images.

Where present-day angular differences between the summer solstice directions and sightlines are off by more than 0.4°, the differences 2000 to 4000 years ago were considerably less, about 0.07°. The winter solstice sunrise angle error increases over time, suggesting the winter marker was established more recently. According to my co-author, this finding may be consistent with archaeological and historical evidence suggesting that the Eastern Woodland Indians did not occupy Cape Ann in winter until sometime in the 15th century at the earliest, although earlier marine-adapted coastal Archaic people may well have done so.

The values in Figure 18 assume the same sunrise/sunset elevation angles at all sighting locations, which would be the case if the builders knew the angles that worked for a flat site and applied them to Sunset Hill. Another possibility is that the builders did not know the angles but observed what did work for Sunset Hill. If this were the case they would have had to take into account elevation differences between the gnomon and other rocks. These differences lead to different solar elevation angles at the summer sunrise and sunset rocks, and the winter sunrise rock that result in a slightly different set of alignments.

Figure 20 shows calculated summer and winter solstice sunrise and summer solstice sunset azimuth angles using adjusted elevation angles in Figure 15 minus 0.5° to account for solar refraction when the sun is just above the horizon. The adjustment assumes an observer 1.5 meters in height at the gnomon (which is about the same height as

Event	Solar Elevation	Present	2000 BP	4000 BP
Summer Solstice Sunrise	-0.50	56.35	56.02	55.60
Summer Solstice Sunset	0.17	303.14	303.49	303.86
Winter Solstice Sunrise	-0.19	121.95	122.33	122.77

Figure 20. Solstice azimuths at rock-specific elevation angles.

the gnomon at its highest point). Additionally, since the summer sunrise rock has a negative elevation, the elevation value of its sightline is clipped to the horizon. Figure 21 plots differences between the measured and calculated angles in Figure 17. Evidently, by using different solar elevation angles at each rock (which would be required if the builders estimated the solstice angles at Sunset Hill by observing sunrises and sunsets there), the summer sunrise and sunset angle differences converge about 1000 years later, earlier in time than if we assume a flat horizon. The winter solstice alignment again appears to be more recent, suggesting that Algonquians did not occupy Cape Ann in winter until a later time. In the known recent history of occupation, Pawtucket seasonal migration between a winter village at Wamesit (near Lowell) and Cape Ann (a distance of approximately 30

miles) included year-round residency only within the last 500 years or so (Gookin, 1674).

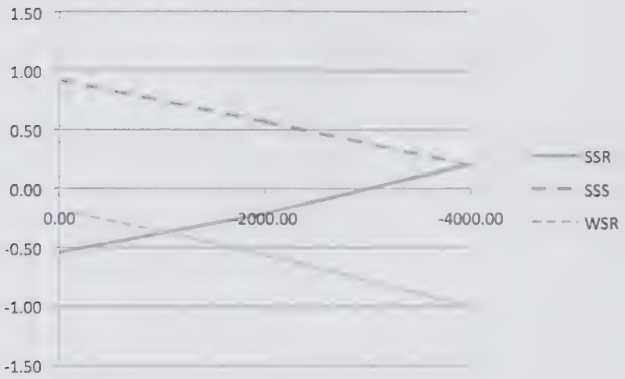

Figure 21. Azimuth angle differences for the summer solstice sunrise (SSR), summer solstice sunset (SSS), and winter solstice sunrise (WSR) taking elevation differences into account.

Discussion

The sunrise and sunset boulders are quite large – their approximate length, width, and height are 2.5 x 1.5 x 2 and 1.75 x 1.75 x 1.5 meters, respectively. We hypothesize the builders exploited the pre-existing locations of these two boulders by positioning a smaller rock – the gnomon – on bedrock near the center of the site to produce summer sunrise and sunset alignments. Of course, had the spatial distribution of boulders been different, a different arrangement (or no arrangement at all) might have occurred. Based on alignment dates we conjecture that the emplacement of the winter sunrise stone(s) took advantage of a serendipitous sightline to the southeast at a later time.

In order to produce the correct alignments from prior knowledge of angles, the builders would have to know the direction of true north in order to compute the solstice angles. We have found a stone north of the gnomon that could have served that purpose (Figure 22). We hypothesize that the builders first found the summer solstice sunrise and sunset rocks and then identified the north reference stone. A sightline was then drawn through the north reference stone in the direction of the north celestial pole. The gnomon, which has been narrowed at the base to facilitate reorientation by slightly pivoting it, was then positioned along this

Figure 22. Stone north of gnomon that could have served as reference point.

line until the angles to the summer solstice sunrise and sunset stones were correct. The winter solstice sunrise stone was positioned at a later date using the same sightline reference.

If the builders did not posses prior knowledge of angles but did know approximately when the longest days occurred, they could have created the alignments for the summer sunrise and sunset rocks in one day, on the summer solstice about 2000 years ago. At sunrise a line would be drawn in the direction of the sunrise rock. At sunset another line would be drawn in the direction of the sunset rock. On the next day, the gnomon would be positioned at the intersection of the two lines, completing the original site.

That the equinoctial line through the gnomon passes close to the highest point on Sunset Hill is another piece of evidence supporting an emerging hypothesis – namely that early people on Cape Ann constructed an accurate solar observatory using only boulders and did so with a minimal amount of effort – that being the initial emplacement of one boulder, the gnomon, at the center of the arrangement. The following probability analysis argues that the likelihood of this arrangement occurring naturally by chance is extremely small.

Given a random distribution of points on a plane, pick any two points P_1 and P_2. For each point, draw a line in any direction through that point.

Provided they are not parallel, the two lines will always intersect at a third point, P_0. Without loss of generality, let points P_1 and P_2 be the locations of the summer sunrise and sunset stones, and the point of intersection P_0 be the gnomon. Let r_0 be the radius of the gnomon and d_1 be the distance between P_0 and P_1. The probability that P_0 and P_1 are oriented such that the line passing through the two points is at a particular angle (i.e., the angle of the summer solstice sunrise) is:

$$p_1 = (2r_0/d_1)/2\pi \qquad \text{(Equation 5)}$$

Similarly if d_2 is the distance between P_0 and P_2, the probability that P_0 and P_2 are oriented such that the line passing through the two points is at another particular angle (i.e., the angle of the summer solstice sunset) is:

$$p_2 = (2r_0/d_2)/2\pi \qquad \text{(Equation 6)}$$

For the measured distances $d_1 = 165$ meters and $d_2 = 130$ meters and a radius $r_0 = 0.6$ meters, the probability that these two summer solstice alignments occurred by chance is:

$$p_1 \times p_2 = 1.8 \times 10^{-6} \qquad \text{(Equation 7)}$$

The probability that the Sunset Hill formation is a random occurrence decreases even further when we take into account the winter solstice sunrise alignment:

$$p_3 = (2r_0/d_3)/2\pi \qquad \text{(Equation 8)}$$

where d_3 is the distance of the winter sunrise rock P_3 from the gnomon (about 91 meters). Assuming each event is independent, the joint probability is:

$$p_1 \times p_2 \times p_3 = 4 \times 10^{-9} \qquad \text{(Equation 9)}$$

In other words for the three solstice alignments to occur at random, assuming statistical independence, the probability is on the order of one in a billion.

In general, the probability of any specific arrangement of points occurring at random becomes extremely small as the number of points increases. Nature does not conspire to produce any particular arrangement, including the one on Sunset Hill. Against such a low background probability, the existence of a configuration containing three possible solstice angles would therefore appear to be highly significant.

Figure 23 a, b, and c depict solstice sunrises and sunsets using Google Earth for the most recent year 2014. Notice the differences between the sightlines to the rocks (lines with arrows) and the position of the sun at apparent sunrise/sunset. Since Earth's obliquity now (23.43°) is less than it was 2000-4000 years ago (23.7-23.9°) the summer sun rises and sets south of where it did then. At

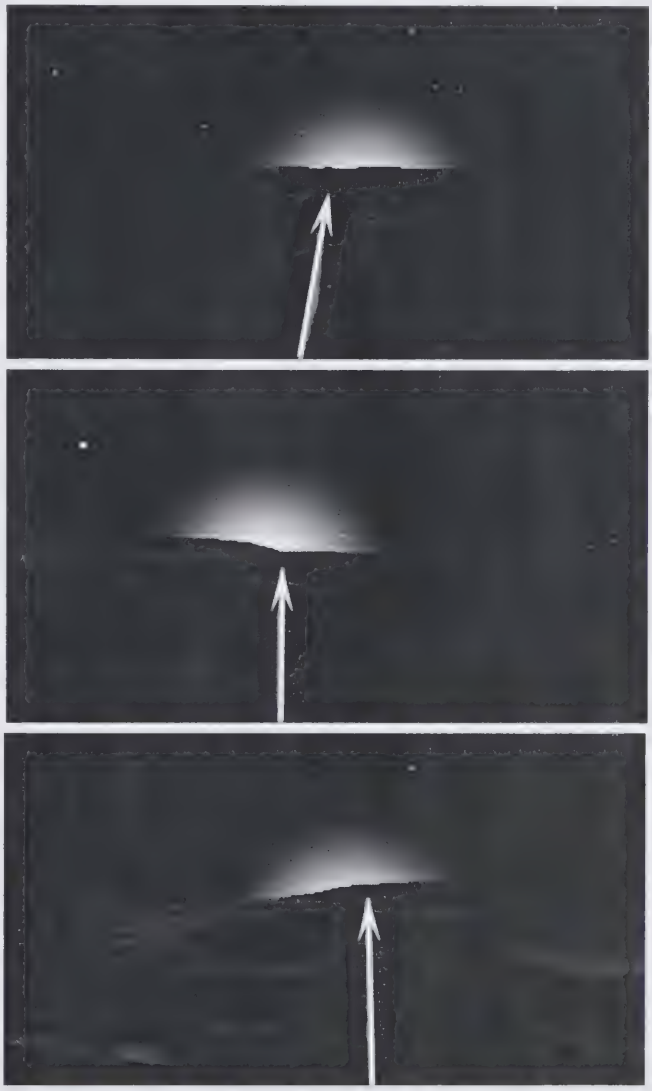

Figure 23a, b, & c. Google Earth renderings of solstice sunrise/sunset at present revealing shifts from sightlines caused by change in obliquity: (a) Summer solstice sunrise; (b) Winter solstice sunrise; (c) Summer solstice sunset.

that time the summer sightlines would have lined up to within about a tenth of a degree.

Conclusions

We believe the landscape of Sunset Hill was modified and used by Native Americans as an astronomical observatory some time prior to the Contact Period. Relevant historical and ethnological research will be ongoing, and we are undertaking further work to assess possible archaeological features seen in aerial photographs: a stone circle or wheel, a U-shaped stone structure, a double-row of rocks, a serpentine structure, a possible quarry site, and possible sightlines to astronomical bodies or events other than solstices and equinoxes, such as lunations, that may have been marked with stones or grooved into the bedrock. We suspect that the use of landscape features for astronomical observation was not tied solely to agricultural needs but predated the introduction of maize horticulture in New England.

We hope to date the alignments using input from geologists about the rocks on the site, their configurations, and physical evidences that they were moved, worked, or used. Dating methods include soil cores in the vernal pools to verify that the hill had little vegetation to obscure sight lines in the past, and lichenology to estimate the age of the boulders in the array. In addition, we are documenting and analyzing other boulders in the landscape that appear to have been intentionally gouged, carved, or pecked with petroglyphs - such as a horned serpent - and as effigies, including a possible Manitou stone. On May 20, 2014, Tim Fohl of Carlisle, a physicist and amateur archaeologist, came to Sunset Hill upon our invitation, confirmed the presence of a ceremonial landscape, identified significant features in that landscape, and observed that the site is still being visited. Our joint paper, The Spirit Rocks of Sunset Hill, is forthcoming.

Acknowledgements

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The Restorative Hand and Mind of William S. Fowler

William E. Moody

Introduction

Those who have been dedicated readers of this publication over the years will be well aware that William S. Fowler was one of the founding fathers of the Massachusetts Archaeological Society (MAS). By all accounts, Dr. Fowler was both a gentleman and a scholar—a meticulous archaeologist in the field, a careful researcher in the laboratory, a widely published author of important articles and books on New England prehistory, and an accomplished artist who often skillfully illustrated his own published works and those of many other writers, both professional and amateur. Fowler served for many years as Editor of the Bulletin and also as curator of the Society's museum collections at the then Bronson Museum in Attleboro. He was certainly respected among peers, as well as being admired by the many MAS members he befriended over the years.

On the jacket of Fowler's 1957 book *Ten Thousand Years in America,* the reader learns that, among many things, Fowler was noted for being one of the few archaeologists of his day to use "Stone Age" methods to reproduce ancient tools in order to better understand the prehistoric cultures he was studying. As the book jacket notes: "In gathering material for this book, and in order to get the 'feel' of archaic living thousands of years ago, Dr. Fowler spent months cutting and attaching [wood] handles to stone implements by primitive methods. Also, he fashioned stone pipes and bowls with the stone tools of aboriginal quarry workers. By this realistic approach, he has rediscovered probable methods of hafting, and of making stone pipes and bowls in the aboriginal way." (Fowler, 1957)

Fowler was a graduate of Yale University and later pursued further studies in anthropology at Chicago University and McKinley Roosevelt Institute of Illinois. He served in the armed forces during World War I, and the early days of his archaeological career included his efforts in founding the Connecticut Valley Chapter of MAS, serving as the Society's secretary and also as the research director of the Narragansett Archaeological Society of Rhode Island. Over the years, Fowler directed many important excavations of archaeological sites around New England. (Fowler, 1957)

After Fowler's passing in 1983, Maurice Robbins (to whom the Society's current Robbins Museum of Archaeology is dedicated), wrote a tribute to his long-time associate. To what is mentioned above concerning Fowler's career, Robbins added: "As a co-worker the writer can attest that no one individual in the history of the Massachusetts Archaeological Society has devoted more time and talent to the organization than William S. Fowler." (Robbins, 1984:2)

There is no question that Fowler maintained friendly relations with many amateur MAS members, often mentoring them and sharing his broad knowledge of regional prehistory. That relationship of mutual respect also resulted in allowing the Society to gain a much wider understanding of the archaeological record and resources in Massachusetts. Many of the sites formally excavated by the Society, for example, were first brought to Fowler's attention by collectors and amateurs.

Apparently, Fowler would host regular get-togethers at his house where avocational archaeologists would often bring artifacts for his perusal. It was not uncommon for collectors to leave broken artifacts that were deemed worthy of restoration in Fowler's capable hands. I have in my possession, for example, a personal note penned as late as 1980 from Fowler to Roland Engstrom, one of the dedicated old-time collectors. Fowler had written from his home, inviting Engstrom and two other members:

"Dear Rolly:
Again time has rolled around to our gathering again at 69 Primrose Hill. I think your two artifacts as outlined are worth having, and I hope you will enjoy them as much as I did in restoring them.

Let me know what Saturday would be best—one in which all three of you could make it over here.

Yours,
Bill" (Figure 1)

The relationship with Engstrom provides a particularly illuminating example of Fowler's involvement with avocational archaeologists. Engstrom had led controlled excavations at the Nunkatusset Site in West Bridgewater, MA, in 1950-1951 and then reported on the results of his work soon after in the *Bulletin* (Engstrom, 1951). As editor, Fowler undoubtedly assisted Engstrom in preparing the report. Also, pictured in that *Bulletin* article are a number of examples of the artifacts Engstrom had recovered, all of which were illustrated by the excellent pen and ink drawings that Fowler so often contributed to this publication.

At some time subsequent to the report's appearance in print, Engstrom certainly must have discussed with Fowler the possibility of having a few of those very same artifacts restored. This is known because, when I acquired the existing Nunkatusset inventory from Engstrom's sons, Peter and Neil, included were some of the very same pictured artifacts recovered during the excavations and which originally exhibited ancient breaks. Now, however, a few of those artifacts had been professionally restored to their complete form by Fowler (Figure 2).

A substantial number of artifacts exhibiting the fine restoration work that Fowler performed continue to exist today in the Robbins Museum as well as in private collections that have been passed down and carefully maintained over the years since Fowler's passing. Maurice Robbins, in fact, had written of Fowler's restoration work in the Bulletin's 1984 memoriam: "Many of the artifacts now on display at the [then] Bronson Museum are a silent witness to his artistic and meticulous work in this field." (Robbins, 1984:2)

Among the classes of New England artifacts that Fowler restored and of which I am personally familiar are ceramics, projectile points, drills, atlatl weights (bannerstones), gouges and celts, and slate ulus. Undoubtedly there are other classes of both flaked and ground stone implements that Fowler also worked on. Figures 3-7 show some of the wide range of restored artifacts from the Engstrom collections. The large Atlantic blade pictured in Figure 8 is from the old collection of Wilbur Wood, another long time MAS member.

Analyzing a number of Fowler's restorations, it is apparent that he primarily employed wood putty (Plastic Wood) in his work. The wood putty readily lends itself to carving into the desired shape in order to match an artifact's missing component and then hardens into shape when dry. Fowler's expert artistry is evident in the detailed painting applied to the restored parts of each artifact. Another interesting aspect of Fowler's work is that despite the fine painting, which so closely matched the original artifact, he did not attempt to hide the restoration. In every instance, it can be clearly observed where the restored element has been attached to the original. I believe this was purposefully done by Fowler so that any future study of the artifacts would not deceive researchers while yet still allowing a viewer to more vividly picture what the complete artifact would have looked like.

Conclusion

Certainly, for a number of very valid reasons, serious archaeological research today would normally eschew the use of reproductions. There can, for example, be significant information to be gained by studying the manner in which a particular artifact may have been used and subsequently broken in ancient times. Nonetheless, restorations of exceptional artifacts and art works are not uncommon in private collections and public museums, even in famous inventories such as those of the British Museum in London. It can be argued that there is both an aesthetic and an educational purpose in providing some restorations for viewing by the public, and William Fowler's work has been duly appreciated and valued by many that have seen his carefully restored artifacts over the years.

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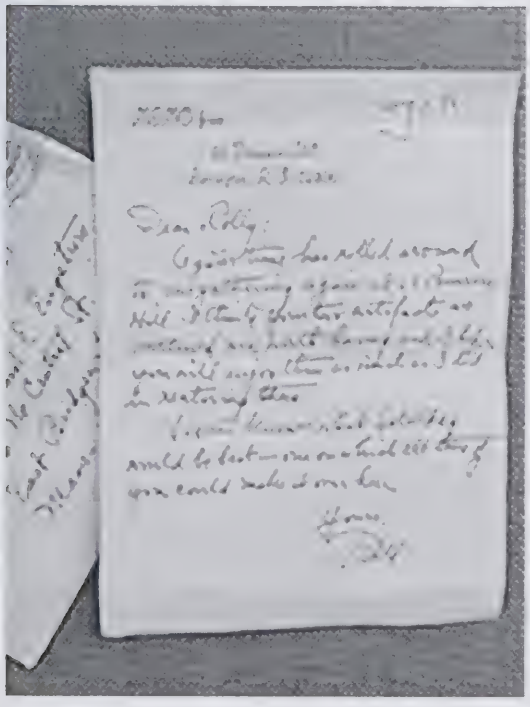

Figure 1. Handwritten note from William Fowler to Roland Engstrom.

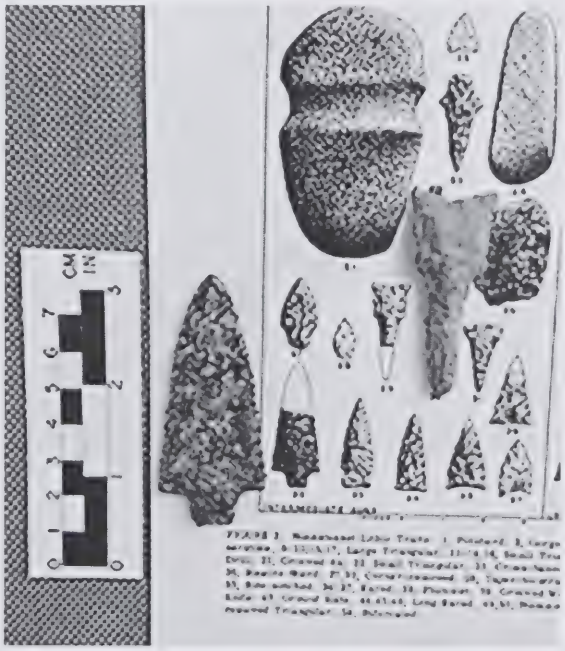

Figure 2. Two restored artifacts from the Nunkatusset Site, West Bridgewater, MA, shown with copy of page from Roland Engstrom's *Bulletin* article showing the original artifacts (for Engstrom collection).

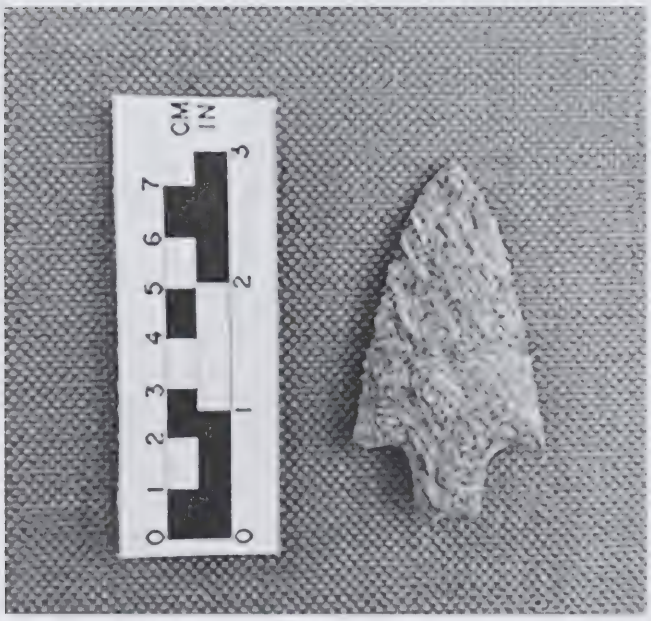

Figure 3. Restored Neville Point. East Bridgewater, MA. Top half restored (for Engstrom collection).

Figure 4. Restored winged atl-atl weight (bannerstone). Plymouth, MA. Approximately 50% restored (for Engstrom collection).

Figure 5. Restored winged atl-atl weight (bannerstone). Bay Farm, Kingston, MA. Approximately 50 % restored (for Engstrom collection).

Figure 6. Restored ulu. Raynham, MA. Approximately 65% restored (for Engstrom collection).

Figure 7. Restored gouge. Route 106, East Bridgewater, MA. Approximately 30% restored, bit end (for Engstrom collection).

Figure 8. Restored Atlantic point. Lake Assawompsett, MA. Top half restored (for Elmer Wood collection).

CONTRIBUTORS

Mark J. Carlotto of Gloucester is an aerospace engineer with over thirty years of experience in satellite imaging, pattern recognition, terrain mapping, and mobile application development. He received a Ph. D. in Electrical Engineering from Carnegie-Mellon University in 1981 and has over one hundred publications in a variety of technical areas. Mark has applied his knowledge of overhead imaging and mapping to the investigation of an abondoned colonial settlement on Cape Ann, Massachustts. He has written two books on the subject, one receiving a Preservation Award from the Gloucester Historical Commission. Together with Mary Ellen Lepionka, he is investigating several pre-Contact sites on the North Shore, including an Algonquian ceremonial site on Sunset Hill in Gloucester. Contact Mark at 978-281-6908 or mark@carlotto.us.

Mary Gage is an independent stone structure researcher. Over the past 20 years she and her research partner developed a stone structure classification and a methodology to study the subject. This was published in *A Handbook of Stone Structures in the Northeastern United States*. She authored two books and co-authored several others that are stone related. She contributes articles on Native American stone structures to their web page stonestructures.org.

Mary Ellen Lepionka of Gloucester is an independent researcher studying the pre-Contact and Contact periods on Cape Ann in preparation for a book on the subject. She is a retired publisher, author (Writing and Developing Your College Textbook, Writing and Developing College Textbook Supplements), editor, textbook developer (Pearson Education, Houghton Mifflin), and college instructor with an MA in anthropology from Boston University and ABD studies at the University of British Columbia. Prior to her career in college textbook publishing, Mary Ellen participated in salvage archaeology on Great Neck in Ipswich, taught anthropology at Boston University and other institutions of higher learning, participated in the excavation of an Iron Age Bantu refuge settlement in Botswana, and conducted fieldwork in Riyadh, Saudi Arabia. Her article, Unpublished Papers on Cape Ann Prehistory, appeared in the Fall 2013 issue of the *Bulletin of Massachusetts Archaeological Society*. Contact Mary Ellen at 978-283-1531 or me.lepionka@verizon.net.

Bill Moody has been a member of MAS for over thirty years, served as a past Trustee, and has contributed a number of articles to the *Bulletin*, as well as to other archaeological publications. He first became interested in Native American prehistory as a young boy at his grandparents' home on the Alafia River in Florida, where he discovered an archeological site dating back at least 12,000 years B.P.

NOTES TO CONTRIBUTORS

The Editor solicits for publication original contributions related to the archaeology of Massachusetts. Authors of articles submitted to the *Bulletin of the Massachusetts Archaeological Society* are requested to follow the style guide for *American Antiquity* (48:429-442 [1983]). Manuscripts should be sent to the Editor for evaluation and comment at c1hoffman@bridgew.edu.

For shorter manuscripts (5 pages or less), texts may be submitted as paper copies. Longer manuscripts should be submitted as electronic files (preferably MicroSoft Word .doc or .docx files, or .rtf files). All text should have margins of 3 centimeters (1¼ inch) on all edges. For electronic files, do not insert artificial spaces between lines; instead, use the Format/Paragraph/Line Spacing function and select "Double". Proper heading and bibliographic material must be included.

Bibliographic references should be listed alphabetically by author's last name and presented as follows:

Gookin, Daniel
1970 *Historical Collections of the Indians of New England* (1674). Jeffrey H. Fiske, annotator. Towtaid, Worcester MA.

Several references by the same author should be listed chronologically by year. Reference citations in the text should include the author's name, date of publication, and the page or figure number, all enclosed in parentheses, as follows: (Bowman and Zeoli 1973:27) or (Ritchie 1965: Fig. 12). All information derived from published sources must be cited, whether it is directly quoted or paraphrased. Please check to make sure that all citations in the text match bibliographical entries, especially dates of publication.

All illustrations and tables, called figures, should be submitted as separate electronic originals. If a large number of figures is involved, authors may use DropBox to send them to the Editor. Tables should be submitted as separate Excel (.xls or .xlsx) spreadsheets and not incorporated into the text. Figures should be submitted as either .tif or .jpg files, high contrast (300 dpi minimum), in greyscale. Each figure should fit within the space available on a *Bulletin* page, which is 17 cm by 23 cm (6½ x 9 inches), allowing for margins. Full, half or quarter page figures should be planned carefully. Width dimensions for one-column images are 3.35 inches (8.5 cm). Space must be allowed for captions. Captions should be in title case and should accompany the text in a separate section, in order and numbered to correspond to the figures.

Figures must be referred to in the text and are to be numbered in their order of reference, with their number indicated in the file name. Every item in each figure and each person should be identified. All lettering must be clear and legible. Scales with dimensions, preferably in metric measurements, should be included with all figures for which they are appropriate.

Dimensions and distances should be given in metric units or in metric units and English units, to the same standard of accuracy (e.g., 10 cm or 2.5 inches, not 2.54 inches).

Authors should include a brief (1 paragraph) biography for the "Contributors" page of the *Bulletin* issue.

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